THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVIII. No. 2009.] LONDON, NOVEMBER 12, 1901. [53RD YEAR. PRICE 6d.

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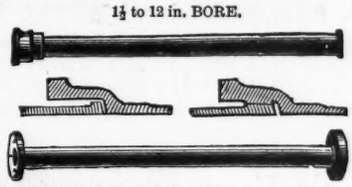

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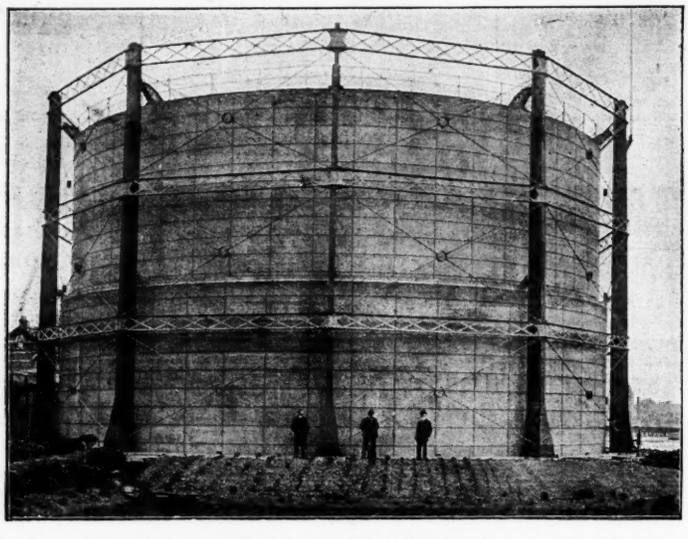

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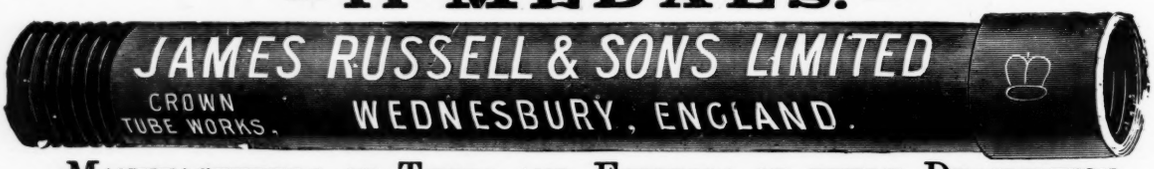

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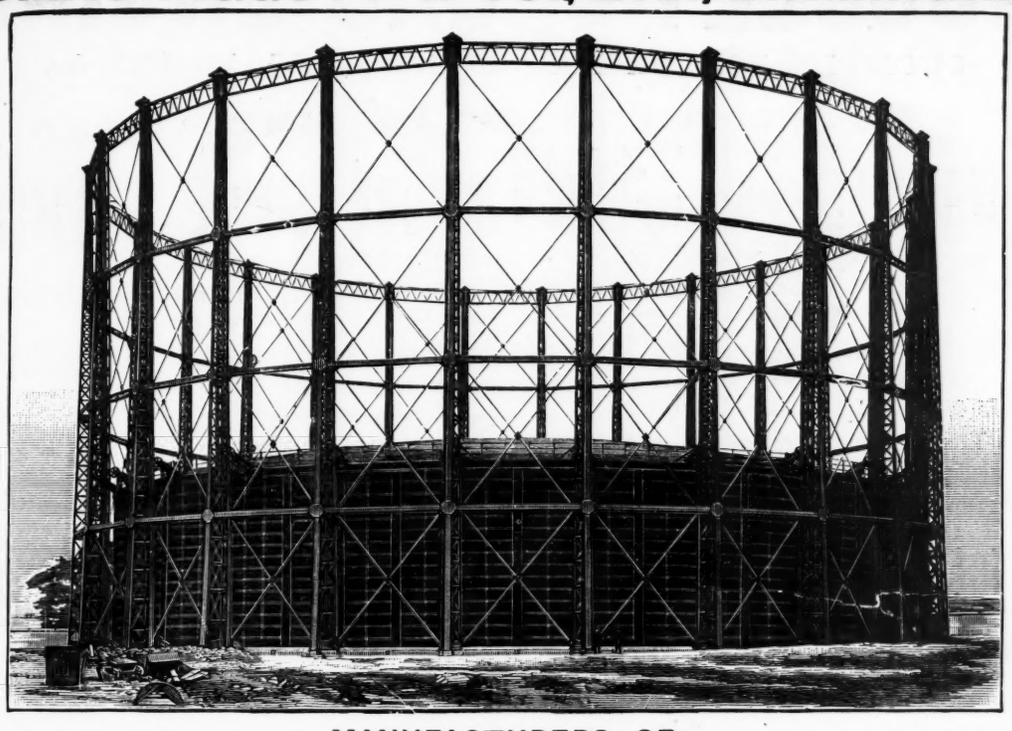

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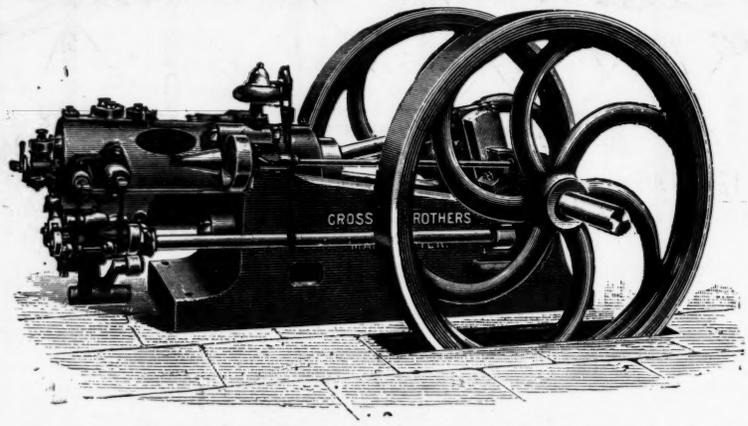

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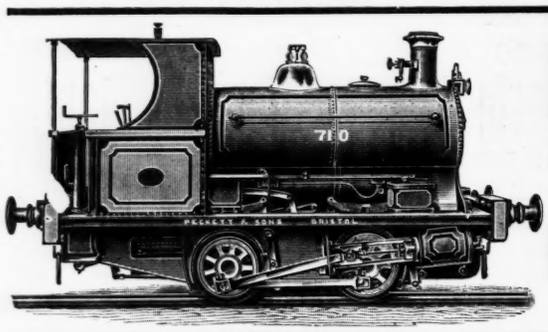

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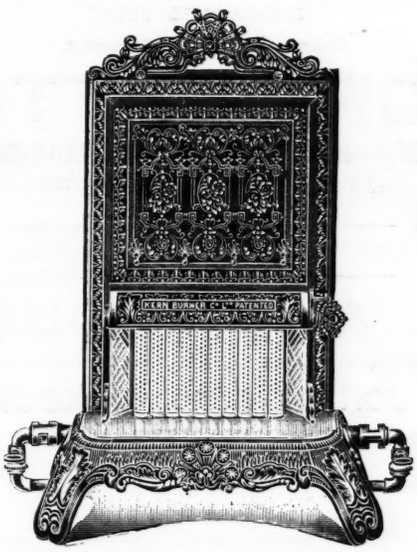

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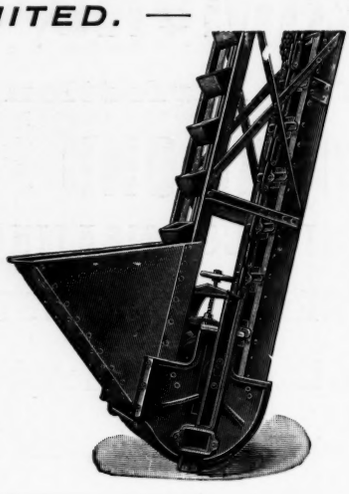

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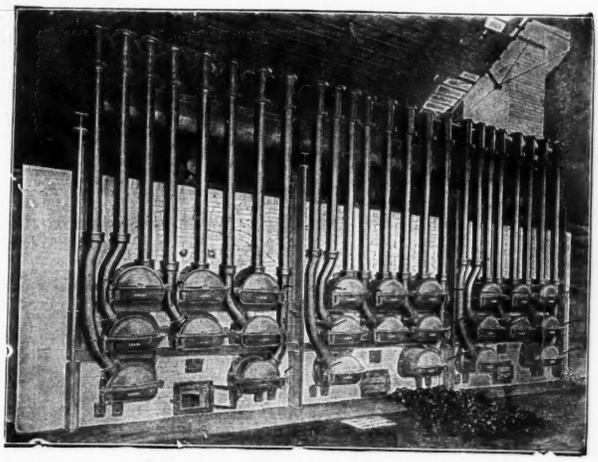

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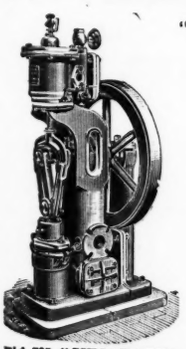

Fig. 705. "SINGLE RAM" STEAM-PUMP.

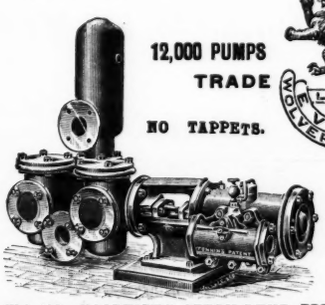

Fig. 698. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

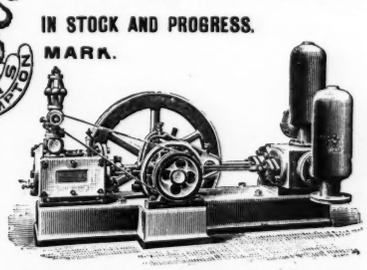

Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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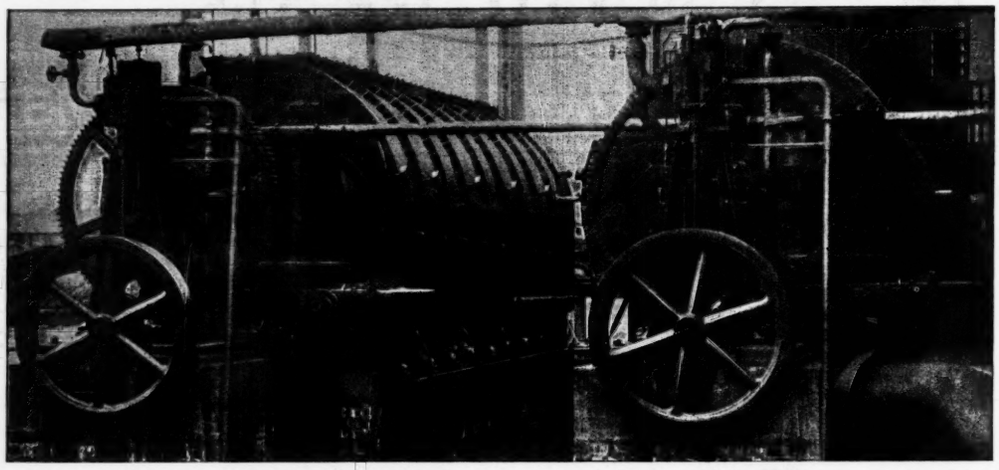

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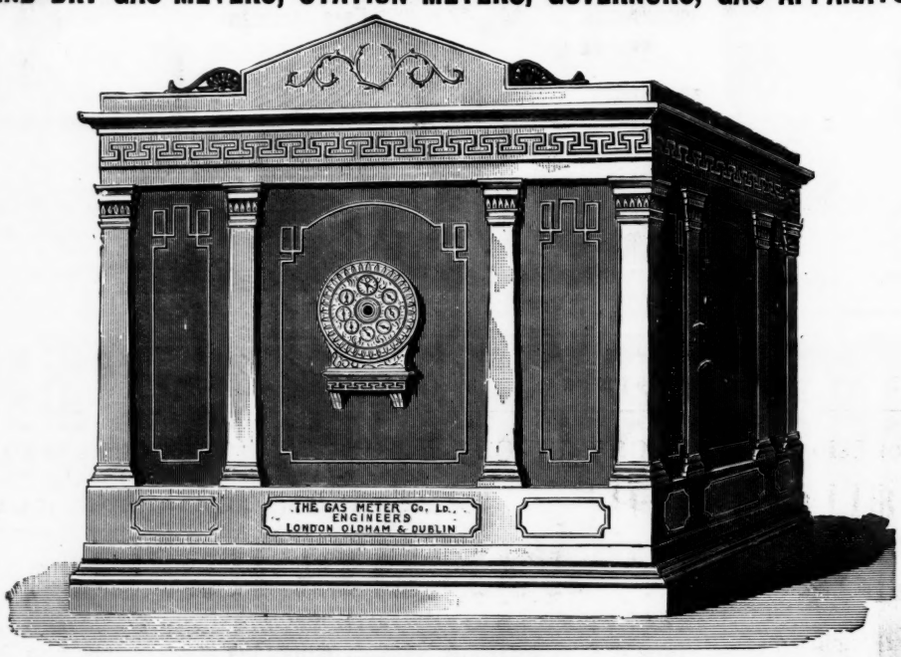

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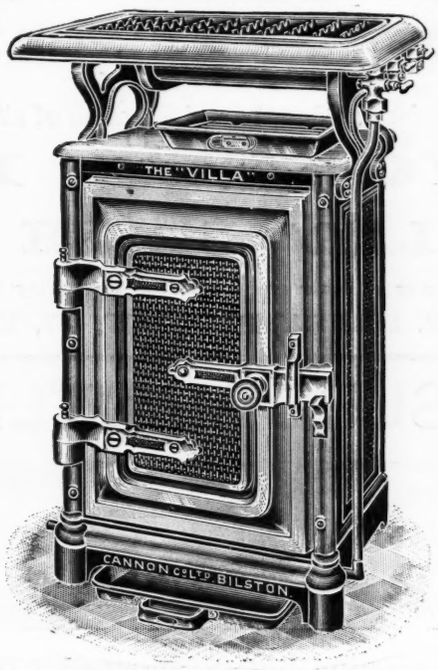

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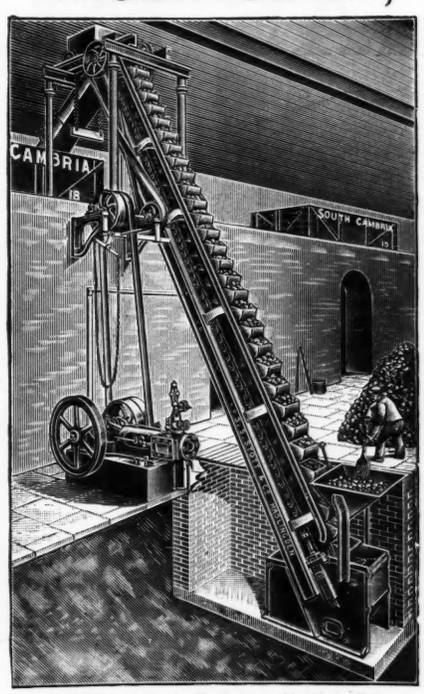

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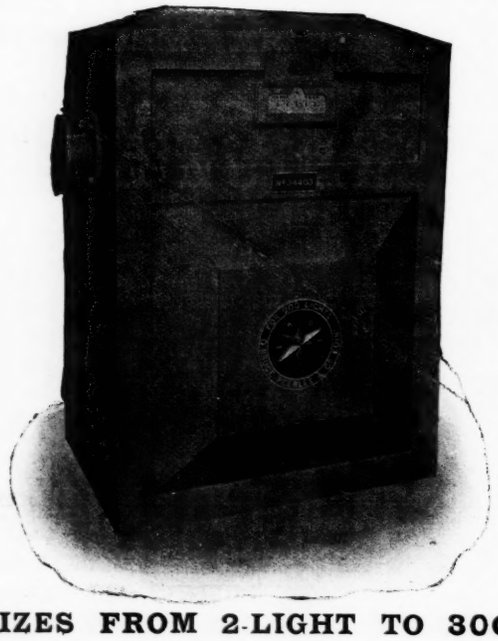

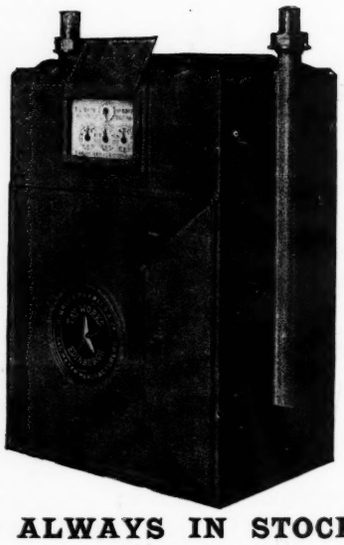

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CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
The Prospects of Trade 1221
A Week of Fog. 1221
Birmingham Gas Affairs 1222
Appeals under the Workmen's Compensation Act 1222
The Situation in South Wales 1223
WATER AFFAIRS—
Another County Council Water Bill . . 1224
Mr. Charles Hawksley on Water Supply . 1224

ESSAYS AND REVIEWS.

The London County Council on Street Subways 1225
An Engineering Contractor's Views and Advice 1226
City and Guilds of London Institute Examinations 1227
Gas and Water Stock Market 1227
The Vienna Municipal Gas-Works . . . 1228
Liberty and Labour 1230
Electric Lighting Memoranda 1231
Utilization of Blast-Furnace Gases for Production of Power. Second Article. . . 1232
Water Acts for 1901 1234

NOTES.

Gas-Engines in Flour Mills 1235
Character of Texas Petroleum. 1235
Treatment of Boiler-Feed Waters . . . 1236

TECHNICAL RECORD.

A Night at the Institution of Civil Engineers —Mr. Charles Hawksley's Inaugural Address 1239
Annual Meeting of the American Gaslight Association—The President's Address . 1242
Intze Gasholders and Tanks—A Recent Improvement 1246
Incandescent Gas-Light for Photography . 1247
Early Plant for Making Water Gas . . . 1248
A Boiler-Feed Injector 1249
Preparation of Prussian Blue 1249

COMMUNICATED ARTICLES.

The Production of Illuminating Gas from Coke-Ovens. By Dr. F. Schniewind . . 1236
Auditing Gas-Works Accounts. By A Shareholder 1238

REGISTER OF PATENTS.

Construction of Gasholders—Lake, H. H. (Intze, O.) 1249
Incandescence Gas-Burners—Trocquenet, C. L. J. 1249
Treatment of Sulphuretted Hydrogen and other Bye-Products from Alkali and other Works—Wilton, G. 1249
Driving Mechanism for Conveyors, Elevators, &c.—Jenkins, W. J. 1250
Gas-Lamp Lighting Devices—Boult, A. J. (Bardot, P.). 1250

CORRESPONDENCE.

Method of Charging Inclined Retorts. . . 1250
The Dellwik and Strache Water-Gas Systems 1250
The Retorts at the Granton Gas-Works . . 1251
Inclines *v.* Horizontal Retorts. 1251
Income-Tax Assessment 1251
The Water Supply of Santos, Brazil . . . 1251

LEGAL INTELLIGENCE.

Supreme Court of Judicature—Court of Appeal—Welsbach Incandescent Gas-Light Company, Limited, *v.* General Incandescent Company, Limited; Same *v.* Barnard; Same *v.* Blackburn Incandescent Gas-Light Company 1252
The Right to Use a Well 1253
Nuisance from an Electric Light Works. . 1253
Conviction for Stealing Gas 1254
Compensation for the Death of a Son . . 1254
A Bankrupt Gas-Mantle Inventor. . . . 1254
Alleged Slander by a Resident Gas Engineer 1254
Deficient Illuminating Power at Faversham 1254

MISCELLANEOUS NEWS.

New Gas-Works Scheme for Birmingham—Proposed New Site and Further Parliamentary Powers. 1254

MISCELLANEOUS NEWS (*continued*)—

Imperial Continental Gas Association . . 1255
Colonial Gas Association, Limited . . . 1256
Southampton Gas Company 1257
Stock and Share List 1257
Birkdale Gas Supply—The Proposed Reduction in Illuminating Power 1258
Gas *v.* Electric Light in Fog 1258
Electric Lighting Notes 1258
London County Council and the Water Question. 1261
Teignmouth Water Supply. 1262
Notes from Scotland 1263
Current Sales of Gas Products 1263
Coal Trade Reports 1264

PARAGRAPHS.

Sunday Labour in Gas-Works 1227
Water-Pipes Damaged by Electrolysis . . 1231
Gas and Water Works Directories and Statistics 1234
Obituary 1235
King's Birthday Honours 1236
Ancient Water-Pipes Brought to Light—Gas Journals in Austria—Gas-Engines in Spain —Additional Water Storage for New York 1239
Municipal Gas-Works Leased to a Company 1242
Asphalte and Manjak in Trinidad—Southern District Association of Gas Engineers and Managers 1245
Utilization of Waste Products 1247
A "First-Aid" Lamp-Post. 1248
Gas-Works Matters at Leeds—Sales of Shares —Shop Window Lighting in Germany—Threatened Strike at the Colne Gas-Works —Leakage in a Reservoir—A New Water Scheme for Earlestown and Newton—Proposed Softening of Barry Water . . . 1265
The New Gas-Works for Slough—Carlisle Gas and Water Managership—Proposed Purchase of the Abercarn Gas and Water Works—Price of Gas and Stokers' Wages at Stockton—Proposed Purchase of the Omagh Gas-Works—Opening of London Roads—Anglo-Belgian Welsbach Incandescent Gas-Light Company, Limited. . 1266

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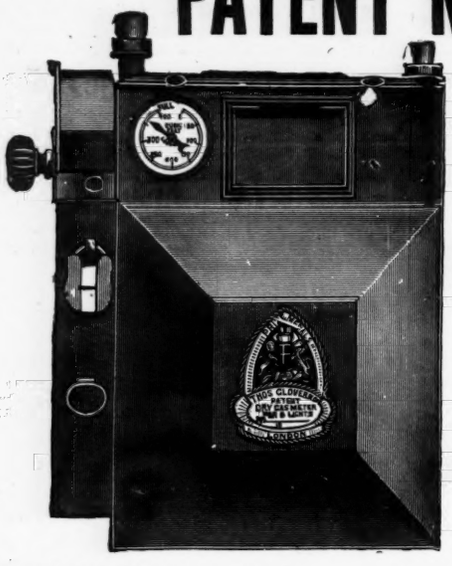

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXVIII., No. 2009.——TUESDAY, NOVEMBER 12, 1901.

EDITORIAL NOTES.

The Prospects of Trade.

As we draw near the end of the present year, the question naturally presents itself as to what are the prospects in regard to trade in the year which will soon be at hand, especialiy so far as the coal trade, which is of such vital importance to the gas industry, is concerned. The publication of the Board of Trade returns for October, and for the ten months of the year, affords an opportunity of examining that and other evidence which is helpful in arriving at a forecast of the future. These returns, considered generally, show a gradual but certain slowing down of trade activity. Considered particularly, they indicate a continuation of the very decided drop in our exports of iron and steel goods, other than machinery; a diminution in our foreign sales of machinery that would be far greater than it is were it not for the activity prevailing in the locomotive trade; and a maintenance of a high, though slightly diminished, rate of coal exports.

In October, we shipped to other countries 3,985,234 tons of coal, as compared with 4,110,568 tons in the same month last year, and 3,601,090 tons in 1899—the value being, however, only £2,612,064 this year, against £3,731,673 in 1900. The shipments of "bunkers" again show an increase quite unaccounted for by any increase in the tonnage cleared—1,232,487 tons, against 1,003,404 tons last year; so that the total quantity of coal exported exceeded the shipments of October, 1900, by 93,749 tons. For the ten months, the figures read: 1901, 48,147,771 tons; 1900, 48,200,724 tons—a trifling decrease of 52,953 tons only. This practical maintenance of the volume of coal exports has been due, in considerable measure, to anticipation of deliveries in order to avoid payment of duty; and this fact must be borne in mind when forming any estimate of the future course of the coal trade.

The continued and increased depression of trade on the Continent is having, and is certain to have, an unfavourable influence upon trade generally in this country, and especially upon the iron and coal trades. Our exports of pig iron bear emphatic witness to this. To Germany—to take a striking example—we sent, in the first ten months of 1899, 381,041 tons of pig iron; in that period of 1900, 415,455 tons; this year, only 183,644 tons. Our total exports for those periods were 1,132,579 tons, 1,271,386 tons, and 721,140 tons respectively. The figures for the month of October show that the decline still proceeds, the total exports of pig iron being: 1899, 151,413 tons; 1900, 113,183 tons; 1901, 67,579 tons. The total exports of iron and steel also show a falling off, in spite of the decided fillip given to the shipments of tinplates and unwrought steel to the United States by the strike of steel workers in that country. The influence of that disturbance having ceased, our trade will tend further downwards.

There does not appear to be any likelihood of a renewal of activity in the Continental markets; so that the outlook for our foreign iron trade is not a bright one, while competition is certain to become keener in regard to coal. That we are already feeling this competition is shown by the statistics of coal imported into Hamburg. Last month we sent 258,000 tons, as against 300,000 tons in October, 1900; while imports from Westphalia increased from 144,000 tons to 169,000 tons. America sent 1496 tons this year; none in 1900; while a consignment of 20,000 tons of anthracite nuts is reported due from Philadelphia this week. Again, the imports into Marseilles during the first half of this year were: English coal, 339,303 tons; American, 97,622 tons. The first half of 1900: English coal, 457,762 tons; American coal, 7739 tons. Welsh colliers, please note!

As to home markets, it is to be observed that the decline of trade has been less marked than it would otherwise have been owing to the great and surprising activity in the shipbuilding yards this year. The output of ships has been enormous; the total for the year will surpass all records. For the ten months, the output has been 1,364,000 tons, as compared with 1,076,737 and 1,185,710 tons in 1900 and 1899 respectively. The orders still on hand will keep the yards going for several months to come; but sufficient fresh orders are not being received to replace those that have been, and are now being, completed. In the nature of things, this was bound to be the case; the only matter for surprise being that so many orders have been given this year. Materials and labour are not dear, freights are at a very low level, and steamers are being everywhere laid up; so that a more unpropitious time for launching so many new ships could scarcely be conceived. Nothing appears more certain than that there will be a very serious slackening of work in the shipbuilding yards next year. That will, of course, have a depressing influence on the iron and steel markets throughout the country.

Bearing in mind the inevitable effect of the continued drain upon the country entailed by the dragging out of hostilities in South Africa—which, as Sir Michael Hicks-Beach warned us last week, will probably mean heavier taxation next year—the conclusion appears unavoidable that a further decline in trade is to be looked for in the coming months. This should give us cheaper coal; and there is no economic reason why contracts should not be made next spring at lower prices than those being paid under current agreements. The uncertain factor in the problem is the human; but the ultimate effect of trouble in the coalfields would undoubtedly be to bring about a still more acute depression in trade. We need fear no return, for many years to come, to the conditions existing in 1900.

A Week of Fog.

AFTER some years of comparative freedom from the nuisance, London—and indeed a large area of England—has been visited with several consecutive days of dense fog. So far as the Metropolis and its suburbs are concerned, this visitation had been threatening for some time. A day or two of "thick" weather would be followed by interludes of brightness. It is at such times that fogs appear partial and capricious. The suburban resident, leaving home in the morning to a boding accompaniment of fog-signals, found almost to his chagrin that the City was favoured with what might be called bright sunshine. Returning at night, the trains on some lines would run into the fog bank again; or the conditions were reversed. All this, however, was but the preliminary to the advent of the real thing, which settled down at the commencement of last week, and never lifted until Friday. It was a fog of the genuine order described once for all in the opening chapter of "Bleak House," and therein classified as a "London particular." Yet even so, unless a great deal of personal testimony is mistaken, this fog did not possess quite the same choking quality as those of an olden time. It was bad enough, however, in all conscience. The interruption of railway and road traffic was most serious; many victims lost their lives in the docks and canals; and the mortality returns were swollen by the deaths of many sick and feeble persons.

At such seasons, it is natural to discuss the phenomenon of fog in all its aspects. The Meteorological Office allowed it to be known that they recognize at least three varieties of fog, of which the worst is that which comes from or with a chilled land surface and a high barometer. This fog is heavy on the ground levels, and sluggish, because there is no movement of the air to shift it. It is also dry. There is another kind of fog which London has experienced much more frequently of late, which does not descend to the ground level, but hangs as a pall overhead. The ground surface is not so cold then, albeit the barometer is usually high and the air still. Lastly, there is the wet mist, which is like rain which does not fall, but makes every exposed surface quite as damp. This kind of fog is usually accompanied with a gentle but perceptible movement of the air. We had the first variety last week, in exceptionally fine form. It drew much attention to the lighting of the streets; and once more the absolute smothering of the electric arc lamps by the yellow fog was manifested. London streets where only arc lamps on the usual tall poles constituted the sole public lighting, were as though unlighted. The police

stopped the omnibus traffic along the whole of the Charing Cross and Piccadilly route thus "lighted."

An avowed partisan of electric light confessed that the arc lamps were useless in the fog, but claimed that a much better effect was produced by the accessory incandescent electric lamps which certain suburban arc lamp standards carry for use after midnight. His counsel therefore was, in time of fog, to turn off the arc lamps and switch on the incandescent lamps! This is only to say that a small light near at hand is better than a so-called 2000-candle power arc lamp 20 feet above the pavement and 50 yards from its next neighbour. The very miscellaneous lighting of different streets in London, due to that conflict of lighting authority referred to by Mr. Corbet Woodall in his Southern District address, provided wayfarers with a capital exercise in picking up lights of different kinds. Mr. L. F. Vernon Harcourt—the Civil Engineer, not the Gas Referee—testifies, in a letter reproduced in another column, to the fog-penetrating virtue of gas as compared with the electric light. Indeed, there is nothing better for irradiating a fog than the ordinary flat-flame gas-burner, or gas flared away from the end of a pipe without any burner at all. On account of the expense, this method of fog lighting cannot be much practised. It is very gratifying, therefore, to learn, from last week's experience, that the high-power incandescent gas-lights, of which so many good examples exist to-day in London—and, moreover, cheap lights—are practically as valuable in the thickest fog as they are during clear weather. That is to say, they are as superior in fog-penetrating power to other lights as they are more illuminating at normal times. This superiority was well exemplified last week on the City bridges which are wisely provided with this kind of gas-lighting. The other London bridges, the Victoria Embankment, and the riparian thoroughfares equipped by the London County Council with improved (?) electric arc lights, were, by common consent, as parts of Erebus in comparison.

Apart from the matter of street lighting, it is gratifying to observe that the science of London fogs has made an impression upon some of the leading newspapers. The "Daily "Graphic" of last Tuesday remarked upon the aggravation of fog by the presence in the atmosphere of avoidable smoke. While pointing out that much can be done to diminish this concomitant of fog without revolutionary changes, it remarks that "if every house in London was fitted with gas-cookers "and modern fire-grates, the sum total of smoke in the air "would be appreciably diminished, even if the factories "continue to evade the law." The worst offenders in the latter category are the electric lighting stations. It was painful last week to pass in the vicinity of these labouring establishments, most of which were making heroic efforts to keep up with the extraordinary demand, and know that overhead they were pouring out torrents of smoke and vapour enough to make a respectable-sized fog on their own account. Fortunately for them, the police could not swear to what was going on. The various local authorities engaged in supplying electricity in the Metropolitan area have petitioned the Meteorological Office to give them forecasts of fogs; and the Office, as we have already mentioned, has asked the County Council for funds to carry on special observations with this object in view. The observatories are to be Fire Brigade stations. It is an interesting idea; but a barometer and set of thermometers will usually prepare any reasonably careful observer to expect fogs. When the atmospheric temperature falls below 40° Fahr. for a few nights, and radiation from the ground is rapid, and the barometer climbs up to something above 30·5 inches and stays there, there will be fog in the river valley as sure as Winter follows Autumn.

Birmingham Gas Affairs.

THE gas affairs of Birmingham are entering upon a fresh chapter, which has lately been opened under somewhat sensational conditions. The growth of the business of the Corporation is increasing, and has necessitated the acquisition of a site for new and additional works. Although the matter has only now become public, the Gas Committee, under the capable leadership of Mr. J. H. Lloyd (the new Lord Mayor), have had it before them for some time. A constant increase of output, averaging 4½ per cent., compels a provident manufacturer to look well ahead, and make sure of his ground betimes. The Birmingham Gas Committee have always done this; and three years ago they made the necessary provision for the growth of their business up to 1905-6. This scheme, however, filled up the available land at the disposal of the Committee; and while they have been watching the fulfilment of their expectations, they have not been unmindful of the consideration that the next move must be in the direction of suitable land purchase. It is scarcely necessary to remark that this is a much more difficult affair to deal with satisfactorily than any mere works extensions on old property. A retort-house or a holder may be hurried forward or kept back as passing influences dictate; but it is hardly possible to be too much beforehand with the acquisition of land that is imperatively over needed.

Of course, the slightest wind of a Corporation or a big Company being in the estate market as possible purchasers of land, is enough to set the "unearned increment" mounting up without sense or reason. Consequently, such buyers have to exercise the wariest policy in even discussing among themselves what may be necessary twenty years in advance. It speaks excellently well for the loyalty of each member of the Birmingham Corporation Gas Committee, as well as for the integrity and business capacity of every one of their advisers, that they have been able to secure an offer of a suitable site of 108 acres, with profitable buildings, at the reasonable price of £143 10s. per acre. The rents actually payable give an immediate return of about 2¼ per cent. on the purchase-money. The Gas Committee have therefore recommended that power to buy and use the land for gas-works purposes should be asked for in the Corporation Bill now being promoted, with further capital powers to the amount of £500,000. It is not often that a great gas undertaking has the opportunity for acquiring ample additional land to hold until wanted without its being a burden upon the current revenue.

It is amusing to notice that one of the Birmingham newspapers tries to persuade the citizens that the scheme of the Gas Committee is uncalled for. Birmingham being supplied, as it is, with gas by a Corporation undertaking, it is extremely refreshing to read how "a very ordinary paterfamilias as he "puts down his newspaper and rubs his spectacles, finds "the quality of the light provocative of strong language; "and when his gas bills come in, his growling is loud and "deep." This is very lovely. It reminds one of the familiar formula invariably used to justify local authorities' parliamentary interference with the affairs of gas companies—"in consequence of the very numerous complaints "received as to the quality of the company's gas, and the "amount of their charges." The Committee's case for the new land purchase is challenged because "in other "cities [not named] electricity is year by year ousting gas "in all the principal shops and factories." This is news; but even if the tale were true, which it is not, it does not afford any good reason for neglecting the needs of Birmingham. It is not denied that the growth of the Birmingham undertaking is as the Committee state; but the question is asked whether this is likely to be maintained. That is as may be. One can only deal with what are ascertained facts. This newspaper critic, however, proceeds on the mistaken assumption that "a city can only require a certain amount "of light; and, therefore, it is obvious that every additional "consumer of electricity means a lessened demand for gas." As if gas was not used for anything besides an alternative to the electric light! What about the slot-meter trade, now only in its infancy, and the enormously growing demand for gas for other than lighting purposes? Moreover, no man can say what is the saturation point of a city for artificial light. The appetite for it is one that grows with eating; and Birmingham, like every other city, can do with an indefinite quantity of light in addition to that now used.

Appeals under the Workmen's Compensation Act.

THE proceedings of the Court of Appeal in clearing off the cases that come before it under the Workmen's Compensation Act are a wonder, a lesson, and a ground for hope. Not since the reign of law superseded rule by club and spear, has such despatch and such splendid incisiveness in the dispensation of justice dazzled any community. It is not too much to say that the work done last week by the Master of the Rolls, and Lords Justices Stirling and Mathew, in their special sittings for the disposal of appeals under the Act, constitutes a glory for the nation such as may be vaunted gladly by those who would see the Victories of Peace not less renowned than those of War. When will other classes of litigation be likewise promptly treated? For, after all, the rights created by the Workmen's Compensation Act are not so very different from other rights of the British subject that they should enjoy a monopoly of quick, cheap, and compressed justice. Who was the Judge who described the

law of England as being like the Grand Hotel—free to all, on the condition that their pockets are deep enough to pay the prices current as charged by the establishment? The administration of the Workmen's Compensation Act is, on the contrary, like a cheap restaurant. The disputes, such as they are, are dealt with in the first place by a County Court Judge, who decides any question either of fact or of law. Any appeal from the decisions is made to a specially constituted bench of three Lords Justices, who, dealing continuously with this class of business, are able to agree upon principles, and apply them with a point and celerity at which ordinary litigants can only wonder. After all, the total amount of litigation under the Act is insignificant in relation to the enormous importance of the subject to employers and workpeople. Those who try to make political capital out of the fact that there is any litigation at all over such questions as "When is a workman not a workman "within the meaning of the Act?" and so forth, would have fuller justification in condemning the Companies' Acts on a similar ground. Every sensible person must perceive, as Mr. Chamberlain, the author of the Act, admitted when recently speaking of it, that where, for good and sufficient reasons, the operation of a law is limited, there must be some "boundary" disputes. Most of the appeals that occupy the Court are of this nature. Sooner or later all the existing limitations to the operation of the Act will be swept away; but this will not give universal satisfaction.

It appears for the time being as if the Lords Justices of Appeal had agreed among themselves to give the benefit of any doubt, in a "boundary" dispute, to the workman. Thus when Messrs. Cory and Sons, Limited, refused to recognize the right of a workman to compensation for an injury received at their floating coal-discharging stage, off Woolwich, on the ground that the structure is not a wharf, nor a dock, nor a quay, their Lordships made short work of the objection. On the other hand, it is equally clear that their Lordships are not disposed to stretch the letter of the Act to cover cases of contributory negligence on the part of the sufferer. This is quite right and proper. Neglect and contravention of rules of working amounting to insubordination are only too common; and it would be monstrous if those who wilfully set safety regulations at defiance were to be relieved from the consequence of their disobedience.

The Situation in South Wales.

THE position of affairs in the South Wales coalfield has not yet reached a crisis; and just for the moment the situation is somewhat less immediately threatening. The men's leaders decided on Friday last to request that a meeting of the Sliding-Scale Committee should be convened this week, in order that they might discuss matters with the representatives of the owners, and resolved not to order any more stoppages at the collieries until after such meeting. But whether the employers—who are said to have determined to proceed only against the men who signed the "stop" notices and the South Wales Federation, not against other individual men, or against the Miners' Federation of Great Britain—will feel disposed to enter into a discussion with the men's leaders after the action recently taken by those leaders, remains to be seen. If they do, it must be accounted to them for peaceableness; for it would be difficult to imagine anything more calculated to drive employers to take severe measures towards the men, and refuse to discuss matters with them, than the policy lately adopted.

The men are evidently somewhat disconcerted, first by the undoubted failure of the "stop" days to achieve the desired end, and its almost certain attainment of the very opposite result; secondly, by the fact that their real objective—the premature destruction of the sliding-scale and the determination of a high minimum rate of wage—should have been so generally perceived and exposed; and, further, by the refusal of the employers, in spite of great temptation, to play into the men's hands by declaring a general lock-out. That their true objective is as stated above, the men are now at pains to deny—protesting vigorously that the prevention of underselling by the middlemen is their sole aim. Mr. Brace, Vice-President of the South Wales Federation, speaking last Wednesday to the "playing" colliers at Maesteg, was unctuously indignant at the suggestion that they desired to precipitate a struggle for a minimum wage and to break up the sliding-scale agreement. "Did not the "sacredness of agreements," he asked, "appeal to work-"men's representatives with the same force as to repre-"sentatives of capital? If it were the leaders' intention to "break up the agreement, for the purpose of forcing the "owners to accept a minimum, would they not have been "astute enough to know that their most favourable oppor-"tunity for such a project was when the boom in coal was "at its highest point?"

We credit Mr. Brace and his colleagues with being astute enough to perceive that to have pursued such a policy at the height of the coal boom would have been a little bit too barefaced to win the sympathy of even the most sentimental section of the public, smarting as they then were under the infliction of top prices for coal. We, therefore, cannot admit the abstention as any proof that they have no intention of pursuing that policy now. As for the suggestion that the "sacredness of agreements" is a matter of concern to the men's leaders, that is really too coolly impudent, coming from a man by whose advice the whole of his hearers and thousands of other colliers were at that moment doing no work, in direct contravention of their "sacred" agreements with their employers! Mr. Brace doth protest too much.

The proposal of the men to discuss now with the coal-owners the present situation and the future, is on a level with that occasionally made by a Trade Union, at the end of an unsuccessful strike, to submit the questions at issue to arbitration. Mr. Brace and his colleagues assure us that the "stop day" policy was entered upon as much in the interests of the employers as of the men, and solely to stop underselling by the middlemen. Then why did they not seek a conference with the owners first, instead of now; why did they give the owners no more than twenty-four hours' warning of the first stoppage; and why did they cause a maximum of inconvenience, with no compensating advantage to themselves, by capriciously fixing on different days of the week for such stoppage, so that the market was unable to anticipate the event?

No; we can see no reason for ascribing the action of the men to anything but a desire to bolster up wages pending the termination of the sliding-scale, and to precipitate that event—which otherwise would not occur until January, 1903, not next year, as has been stated—as soon as possible. Now that it is becoming evident from the market reports that the effect of curtailing the output has been to divert a very considerable amount of business to the North of England and Scotland (where, owing to the close of the Baltic season, buyers of steam coal find it easy to obtain their requirements), and that the Welsh coal market will suffer heavily in consequence of the uncertainty of obtaining supplies in accordance with schedule dates driving many future contracts elsewhere, so that prices are likely to fall sooner than they would otherwise have done; and now that the employers have shown that they do not mean to submit quietly to the control of their affairs passing into the hands of their employees—the men propose that the owners should meet them to discuss what is to be done! If the owners consent to attend such a conference, we should hope it will be merely to express in no uncertain language their views as to what has been done. Then the men will, no doubt, tell the public that the owners are too unreasonable for them to be able to arrive at a *modus vivendi*, and stop days will be resumed and a struggle be precipitated. We only wish we could believe that the men perceive the folly and culpability of their procedure; but sufficient grounds for the belief do not exist.

We commented last week upon the stupidity of the idea that the middlemen, who are so freely abused by the men, sell coal at prices lower than the "higgling of the market" proves to be the best obtainable. Mr. Brace has now given instances of sales to which the men take so much objection. These prove to be several considerable contracts for delivery in the Mediterranean next year at prices about 2s. to 3s. lower than those current. Looking to the general prospects of trade (which we discuss to-day in another article), we can only say that the buyers would have been guilty of great want of prescience had they agreed to pay any higher prices for future delivery, and that the miners might as well try to turn the tide from the shores of Wales with a broom as try to sell coal next year at the prices now current. Mr. Brace says that the coal so sold by the middlemen (if middlemen always make such bad bargains, why do not the collieries sell direct to their customers?) has yet to be bought from the owners. "Therefore, when these middlemen come into "the market, they must be made to pay such prices as "would mean fair wages"—that is to say, according to Mr. Brace's views, higher prices than those at which they have sold. What would be the result? The middlemen would

be "broke;" and the buyers would get their supplies most probably from the North of England or from America. And where would the Welsh collier be then, poor thing? The changed attitude of the men is hailed in some quarters as a sign that a crisis will for the present be averted. We hope so, but confess to considerable doubt.

WATER AFFAIRS.

Another County Council Water Bill.

By the very substantial majority of 53, the London County Council decided last Tuesday to adopt the recommendation of the Water Committee, as embodied in the report presented at the previous meeting, and promote a Bill next session, on the lines of the one which was rejected last year, to enable them to purchase the undertakings of the Metropolitan Water Companies. With a contemptuous disregard of the assurance given by the President of the Local Government Board that the London Water Question would be specially dealt with in a Bill to be introduced by him next year, the Progressives of Spring Gardens think it incumbent upon them, in the professed interests of the ratepayers, from whom they consider that they have had a "mandate," to add to the already large amount—something like £60,000—they have squandered in abortive attempts at water legislation, by the expenditure of a few more hundreds, or it may be thousands, with no better results, as far as one can judge. The Council may introduce their Bill, and have it read the first time; but we shall be greatly surprised if it reaches the Committee stage. Their precipitancy may only have the effect, as pointed out by Mr. R. A. Robinson, the mover of the temperate amendment which, if carried, would have placed the Council in a position to discuss amicably matters of detail, of placing them in hostility to the Government, and consequently be much more harmful than beneficial to their cause. If they believe that by putting themselves in evidence with their Bill they will "draw" Mr. Long, we fancy they are greatly mistaken. He has not deemed it advisable to show his hand to their Water Committee; and we very much doubt if any member of the Council itself is justified in giving any assurance whatever as to his intentions. The Government must be trusted. It may be very "simple-minded," as one prominent member remarked on Tuesday, to do so; but the majority of the public will no doubt consider them to be as worthy of the trust as the authority in Spring Gardens, who are so fond of trumpeting themselves as the champions of the ratepayers while they lavishly spend their money.

Mr. M'Kinnon Wood, the Chairman of the Water Committee (who do not seem to have been of one mind), naturally stood up for the Bill, and declared that the Council would be betraying their trust if they accepted the recommendations of the Royal Commission. Mr. B. L. Cohen, on the other hand, strongly condemned its introduction at the present time on financial grounds. He considered that the existing condition of the Money Market was most unfavourable for entering upon such a scheme as the purchase of the London water undertakings; and he questioned whether any Bill to sanction it, however ideal, could be placed upon the Statute-book. His speech was full of forebodings of evil, not the least of which would be depreciation of the Council's stock by the creation of an additional £30,000,000 or £40,000,000 sterling to complete the purchase. He counselled further control rather than acquisition. But his views were disregarded. A good deal was said, in the course of the discussion, about the delay which has taken place in bringing this question to a settlement; and the blame was thrown upon the Government. It was well, therefore, that Mr. Emden had the courage to remind the Council that the purchase scheme proposed by Mr. Cross was frustrated by the Radicals. But he did more than this. He frankly told the Council that such a Bill as the one they were asking to promote would not pass even under a Radical Government, inasmuch as Parliament has never sanctioned confiscation. This was a very unkind remark; but it fell practically harmless. The Council had evidently made up their minds to have the Bill again before Parliament; and, so far as can be seen, they will achieve their object.

Mr. Charles Hawksley on Water Supply.

The eighty-third session of the Institution of Civil Engineers opened last Tuesday under somewhat exceptional circumstances. Owing to the inability of Sir William White, the Senior Vice-President, to accept nomination to the presidency, through ill-health, which has since compelled him to deprive the nation of his great services, his place had to be taken by Mr. Charles Hawksley. The event was unique in the history of the Institution, inasmuch as it was the first occasion on which the presidential chair had been filled by the son of a former President, both being prominent in the same branch of civil engineering. But apart from this was the unusual occurrence of two Water Engineers in succession occupying the highest position in an organization of such world-wide importance as that whose headquarters are in Great George Street, at a time when the Water Question in the Metropolis is, so to speak, hanging in the balance between the Government's intentions and the County Council's desires. It was possibly on this account that, in the interesting address in which the new President reviewed the engineering progress of the past century (an abstract of which appears elsewhere), he thought it prudent to leave this subject severely alone. On one point, however, germane to it, he gave utterance to a very clearly expressed opinion. He has, of course, had many opportunities of studying the arguments brought forward in support of the transfer of water-works to local authorities, and has recognized the unsoundness of many of them. The result is that he confesses to being unable to agree with those who advocate the municipalization of these undertakings; and he gives his reasons for taking up this position. Among other points urged in favour of retaining control by private owners was that they could be kept up to their duties by the local authorities, whereas to move a supine public body the ratepayers are helpless. To perform such an operation requires the advent of a drought similar to that through which we have been passing. Another matter to which appropriate allusion was made by the President was the disturbance of the streets; and he did well to remind his professional brethren that the blame for opening the roads directly they have been repaved should not be exclusively laid on Water Companies, seeing that this is a by no means infrequent cause of friction between the Streets and Water Committees of Corporations.

As the son of the originator of the constant supply, the President naturally had something to say on this important part of the business devolving upon the owners of water-works. Since its introduction by the late Mr. Thomas Hawksley half-a-century ago, how marvellously it has developed. Here, in the Metropolis, about 95 per cent. of the entire number of houses have an uninterrupted service of water; no less than 34,586 having been put on last year. With such a service, the President showed that very considerably less than the 28 gallons per head with which Londoners are supplied for purely domestic purposes are sufficient. In fact, he quoted 19 gallons and 18¼ gallons as the averages in the cases of certain groups of towns served by Companies and Local Authorities. If an all-round 20 gallons are all that is necessary for domestic use, what becomes of most of the rest? It goes to waste through defective fittings. The fact that these should be permitted to exist called forth the strongest remarks contained in this portion of the address. But the President unhesitatingly put the blame upon the system which empowers a Government Department possessing no special knowledge as to the distribution of water, and regardless of the experience of fifty years, to persist in so modifying regulations submitted for their approval as to render them impracticable for maintaining the constant service. On this matter, Mr. Hawksley suggested united action in an application to Parliament for relief from this interference; and it seems to be fully justified. In fact, the time is approaching when this and other questions connected with water supply, sanitation, and the public health, will have to be dealt with, as has been over and over again suggested, by a body specially constituted for the purpose.

The late Mr. E. T. E. Besley, K.C., whose death was announced in the "Journal" for the 24th of September, left personal estate to the amount of £81,602 gross and £81,239 net.

The late Mr. G. Butcher, Chairman of the Aylesbury and Tring Gas Companies, whose death was announced in our columns some few weeks ago, left real and personal estate to the value of about £100,000.

The President of the Board of Education has appointed Professor Hugh L. Callendar, F.R.S., to the Professorship of Physics in the Royal College of Science, vacant by the resignation of Professor Rücker, who has become Principal of the University of London.

ESSAYS AND REVIEWS.

THE LONDON COUNTY COUNCIL ON STREET SUBWAYS.

THE revived interest in street subway construction exhibited by the London County Council, possibly in the expectation of directing public attention from their persistent blocking of the Victoria Embankment whenever they wish to remetal the road surface, has gone further than the passing of the resolution discussed in our "Editorial Notes" of the 29th ult. The *agenda* paper of the County Council for last Tuesday contained a report from the Highways Committee suggesting an immediate application to Parliament for powers to construct subways for gas, water, electric and other pipes, wires, &c., and also for tramways. This recommendation is stated to be the outcome of several references to the Committee, from the result of the Subway Conference of June 29 and Nov. 7, 1900, down to the suggestion of June 13 last, in regard to the question of the desirability of the adoption for London of shallow underground tramways as used in New York. It will be remembered that the Council's Tramways Manager and Electrical Engineer were commissioned this last autumn to visit the United States for the purpose of inspecting these works; and the present report is the first fruit of their inquiries—hurried out while the wind of public opinion is favourable, and while there is yet time to give the necessary parliamentary notices. For the sum and substance of the report is the definite expression given in it of these officers' judgment, "that it is extremely desirable that an endeavour should be made at the earliest possible moment to introduce a similar system for London." This, then, is the important new fact which has moved the Committee to recommend an application to Parliament, which, there is good reason to believe, they would not otherwise have contemplated.

The subject is obviously of serious moment for the owners of gas and water mains and all other public services using the subsoil of the streets, which must be displaced if the suggestion of the Committee receives the sanction of Parliament. It is, therefore, desirable to ascertain precisely what the suggestion is—that is to say, what there is new in it. For the resolution of the Subways Conferences of 1900 merely stated "that in all new leading thoroughfares subways should be constructed in which the water and gas mains, pipes, &c., could be placed." This expression of opinion merely repeated what has been a ruling principle with the County Council and their predecessors, the Metropolitan Board of Works—and, be it also said, of the Corporation of the City of London, who have in their possession, and under their successful management, the finest pipe subways in existence. While the Improvements Committee of the County Council could point to the record of the Council in this regard, of course they ignored that of the Corporation, in accordance with the habitual practice of Spring Gardens in relation to the Guildhall.

This superciliousness of the upstart busybodies who happen momentarily to rule the counsels of Spring Gardens, is not the behaviour best calculated to obtain a satisfactory settlement of a difficulty of which the City Corporation had experience before the rest of London possessed any local government at all. The story of the London street subways is succinctly told in Vol. II. of "King's Treatise on Coal Gas," where the leaders of the present County Council will be well advised to study it. Mr. Emden, who recently assured his colleagues of the Council that it would pay to make a pipe subway even underneath the Strand, curiously echoed the idea of Mr. John Williams, stationer, of Cornhill, who, in 1817, pressed the subject upon the attention of Mr. Michael Angelo Taylor, M.P. for Durham, destined to be immortalized by his useful Act for improving the condition of the streets of London. Like town sewage, street subways were at first believed to be capable of being turned to profit; but realization of the project failed to justify the expectation. The first pipe subway in London was made in a new street in Covent Garden, about 1860. It was a reasonably-proportioned affair, 13 ft. wide and 6 ft. 6 in. high. Being a half-circle in elevation, however, it has not much room in it. A subway was made in the Victoria Embankment, 9 ft. wide and 7 ft. 3 in. high—obviously too small for anything. So many of the public works of modern England are spoilt by the timidity or lack of imagination of the designers! It was not until the construction of the Holborn Viaduct, from the designs of Mr. W. Haywood, the Engineer to the Commissioners of Sewers of the City of London, that pipe subways adequate to their purpose were made as an integral feature of a great thoroughfare. There has only, we believe, been one gas accident, and that not serious, in the working of this subway. Every new street-service made in the City of London has since been provided with pipe subways as a matter of course; and, so far as our knowledge extends, no objection whatever has been offered by the Gas Water Companies to the placing of their mains in these subways—where they are large enough.

Obviously, the constantly increasing size of gas and water mains constitutes a serious obstacle to the acceptance without reserve by gas and water companies of a statutory obligation to place all their mains in street subways, where these exist or may at any time be made, and not in the roads under any circumstances. It is on record that the New River Company absolutely refused to place their main in the subway constructed by the London County Council in Rosebery Avenue; and the same Company have just laid a large trunk main in the Victoria Embankment regardless of the subway, which, indeed, is far too small for it. It does not appear from this necessarily cursory review of the subject that the London County Council have any justification for their attempt to dictate to the Corporation of the City of London what ought to be done in the matter. Besides, the City Corporation are already in possession of ample powers, not only for making pipe subways, but also for constraining Gas and Water Companies having statutory powers to lay mains in the City, to avail themselves of such works when made. By the City of London (Various Powers) Act, 1900, the Corporation are empowered to provide what are called "public service works" of this character. The Act was not opposed on the merits by the Gas Company, who only stipulated that it should not put them to any extra expense in the fulfilment of their obligation to the public. On the other hand, anything they might save by it is to go to the Corporation by way of rent for the accommodation provided. There is nothing to find fault with in this arrangement.

The difference between everything that has already been done in this regard, and what the London County Council are now advised to attempt—on the spur of the moment, as it were—is considerable. The Tramways Manager and the Electrician, who form one team in the circumstances, have returned from America enamoured of the shallow tramways subways of New York and Boston, "where the system is in operation," says the report. Is this the fact? We were under the impression, received from American engineering journals, that, in New York, at any rate, the "rapid transit" lines had been in course of construction for several years, and are yet unfinished. In Boston, where the street tunnelling was attended by the most disastrous gas explosion on record, the line may be complete. This is the kind of tramway subways that rather took the fancy of the Joint Committee of Parliament who sat last session to consider the new schemes of underground railway for London. The idea is an admirable one. Instead of confining the subway to a mere rat-hole, not large enough to accommodate an adult gas-main, the tunnel is to be made big enough to take a line, or lines, of tramway, besides all the pipes and cables required for the thoroughfare. It is easy to credit the report brought back from America that, so far as the relief of the street traffic is concerned, the tramways subway is very successful. Owing to the shallow depth at which the lines are laid—the surface of the street being merely stripped off temporarily and relaid by a sort of "cut-and-cover" method—there there is little or no difficulty as regards entrances and exits. Of course not. That is a platitude.

The inference the Committee draw from this captivating report is that, notwithstanding the obvious costliness of this construction, with a tramway line in the middle and pipe-chambers on each side, the County Council "should seek to obtain powers for the construction under the streets of such tramway subways as may be considered desirable for the purpose of linking up the various surface tramways north and south of the Thames." There is a splendid chance for trying the system in the new thoroughfare already in course of construction between Holborn and the Strand. The pipe subways for this street are already authorized; and all that is necessary is parliamentary sanction for the cutting out of the middle of the road for the tramway, which would not cost more than £282,000. One of the termini of the Council's northern system of tramways is at Theobald's Road, Holborn; and the Council will apply next session (as usual) for powers to construct tramways along the Victoria Embankment. The proposal accordingly is to join the two by the line passing under Wellington Street, through the new street, and so to Theobald's Road or Rosebery Avenue, whichever should prove the more convenient. This, then, is the project which the Highways Committee recommend, as they say, "after having given the greatest consideration to the matter." It will be interesting to learn how long this study has really lasted.

So far as the Gas and Water Companies are concerned, it will not matter in the least whether the subways to be provided for their use in the new West Central street are supplemented with a tramway tunnel, or not. They will not have to pay for the luxury. But the ingenious Highways Committee propose to preface their "Victorian Embankment to Theobald's Road" scheme with a general clause for authorizing the construction of similar works "where desirable;" and this will demand consideration. It will be noticed how artfully the particular scheme advocated is made to help forward the Embankment tramway scheme, which has been rejected by Parliament over and over again. There is no reason why the short line of subways tramways debouching on the Embankment should not be made without spoiling the latter for the use to which it is at present put—when not blocked by the County Council—of what the Americans would describe as a "drive way." Whether this will suit the book of the Council is another question.

It should not be overlooked that London is not without old-established examples of the shallow street subway for comparatively fast traffic. The greater portion of the Metropolitan and District Railways is of this character—just beneath the street, platforms approached easily by short flights of steps, and so forth. These lines, however, were neither easy nor cheap to construct. Whether a tunnel is wanted for an underground railway or an underground tramway, the cost of construction must be pretty nearly the same. The illustrations of the New York job published from time to time in the "Engineering Record" and other

journals, do not reassure one on this point. We understand that the usual period for the construction of a street length in New York has been two years, during which in the comparatively narrow streets of London all the wheeled traffic on the surface would be stopped. For this reason, the lines are not made through the busiest streets, but along parallel thoroughfares, which, it is hardly necessary to remark, do not everywhere exist in London. It would be an insult to suggest that in the great consideration they have given to the subject since the return of their emissaries from the United States, the Highway Committee of the County Council have not plumbed all these conditions to the bottom. Besides, it is one thing to make a shallow tramway subway in a brand new street, as the District Railway was constructed along the Embankment. The real difficulty lies in dealing with the old thoroughfares, such as the Kingsland Road or Westminster Bridge Road. How is the case of the latter to be rendered easier of settlement by anything now proposed? It was not necessary to send to America to learn how to make a trench in a new street, whether for pipes or tramways.

AN ENGINEERING CONTRACTOR'S VIEWS AND ADVICE.

Among the successful men of to-day must be numbered Sir John Jackson, F.R.S.E. He is yet only fifty years of age; but he has seen 25 years as a contractor for public works. More than 20 years ago he carried out contracts which were at that date spoken of as large; and since then he has been engaged on many of the notable schemes executed in this country—among the number the Manchester Ship Canal. Still in middle age, and 20 years ago in the full swing of great things, no better man could have been found to serve the Institution of Junior Engineers as their President, and to address them at their inaugural meeting this session. He is not so far removed from the age when he had his life's work before him that he cannot now, with fulness, sympathize with the aspirations of the younger men of the profession, and tender to them advice from his store of matured experience. Sir John, however, was somewhat dubious about accepting the duties which the "Juniors" were anxious to put upon him. But, fortunately for them, he consented; and their transactions will be the richer for the wholesome counsel that he gave them in his address a week or so since. But the address is not limited in its interest to the younger aspirants for professional honours; in parts it appeals to a larger section of the engineering world. Indeed, there is something refreshing in examining into things from the engineering contractor's point of view. Contractors as a rule execute, but do not say much outside the hard-and-fast lines of their specifications; and therefore it is not often they are heard on the general and large affairs pertaining to the engineering life.

In many respects and on many subjects, Sir John Jackson's views coincide with our own; and were it not for the mass of matter which we have now weekly to deal with, we would gladly give publication to the whole of his address, which possesses an innate strength that stamps their author as a man of a character finely polished and moulded in noble proportions. Among his subjects, he discusses the best form of training for a young man who contemplates taking up a high position in the profession of engineering. Although some of the ablest of the earlier engineers of the past century were men of no, or had comparatively little of what may be termed, school education, it is, of course, all-important that a young man who in these days proposes to enter the profession should in the first instance have had a liberal education at some good public school, be of good physique and constitution, and be a man reasonably fond of sports which are so conducive to health, and, as a consequence, to good work. Sir John agrees with what, we believe, is now almost universally admitted—that two or three years spent in mechanical shops immediately after leaving school is most desirable, in order that the budding engineer may get a knowledge of the use of tools and machines, and what in after-life will be found of vast importance, a knowledge of the feelings and modes of thought of workmen. This knowledge can never be gained in any other way than by constant and really intimate contact with workmen for a period. Besides this, a good stamp of British workman will always be found willing to assist a student who can take off his pride with his coat, with practical information on many points which can only be properly acquired in a workship and from the workers. Some folks consider that during the period of practical training, scholastic studies should be continued in the evening. But Sir John does not speak strongly in support of this strict regimen of "all work." If a student can with advantage attend evening classes or work at home, by all means let him do so; but this, of course, must not interfere with his timely appearance and duties in the workshop. Sir John tried evening classes while passing through the workshops; but it was not altogether successful, as he appeared to have been frequently affected by somnolency during the lectures. This is Sir John's view: "I should advise that while a boy is at school, without interfering with his general education, more particular attention should be given to those subjects which are the most important for the young engineer—such as mathematics, geometry, mechanics, and physics—as would ensure that, at the end of his workshop experience, he would be well prepared for proceeding to the more advanced technical college, where he would probably take up special subjects, gaining the advantage of theoretical training in conjunction with laboratory work, before taking up his position as pupil in the office of an engineer. A knowledge of modern languages, too, is of great importance; and the young engineer who is a linguist may find he is sent abroad, with opportunities of gaining information of foreign work and men which he would otherwise never have the chance of acquiring."

Following the educational and preparatory stage comes the work of life; and here Sir John Jackson spoke from his own well-stocked book of experience. Many of those who heard him may become contractors' engineers; and they will have to realize—as he told them—that, to be successful, the all-important qualification for a man in such a position is not only to be able to design his plant and temporary works (the responsibility of which on large contracts is now almost always put upon the contractor) satisfactorily, and in every sense right from an engineering point of view, but be able to do so with the most economical materials, with the least practicable expenditure of labour, and yet so ample for the requirements of the job in hand—having regard to risks, time for completion, and otherwise—that no fault may be found. But beyond this, he must also be a man with a thorough grasp of figures; so that, as a surveyor, he may be always able to hold his own, to judge correctly, think quickly of the relative values of figures that may come before him, and readily form a correct opinion of "the value of an error."

Later on in the address come some words of regret regarding the great lack of mutual confidence and sympathy which should prevail between employer and employed; and then Sir John gives proper measure to the methods and doings of Trades Unions. He sums up their position thus: "If the leaders of these Unions had their way, the non-union men would be doomed to compulsory idleness; and this, forsooth, in this grand old country of ours in the name of Liberty! It has been said that, in consequence of the Taff Vale Railway decision, some of the Unions have proposed to dissolve; but if properly carried on, there can be no just reason for this. They must, however, be made to realize that in free England every man shall have the right to live and sell his labour as he thinks best." Trade rings and combinations then come under condemnation. Sir John Jackson has no sympathy with them. He is altogether opposed to what may be termed "cut-throat competition" among producers or manufacturers (of which he is sorry to see there is so much among contractors); but, on the other hand, he looks upon such combines as have recently been set up in the United States, and suggested in England, as combinations against the "public weal," which as far as possible should be prevented by all legitimate means. Before long the intelligence of the American people will cause them to realize, if they have not already begun to do so, who has to "pay the piper" in this connection. The spirit of a healthy, but not undue competition, is a spirit far preferable for the benefit of the nation to the one now in vogue across the Atlantic.

A reminder comes from Sir John Jackson, in a subsequent part of the address, as to the great loss of life which, sad as it has always been "is unavoidable" on public works. "Is unavoidable" are Sir John's words; and coming from a contractor of such standing, they have a painful significance. According to the insurance companies' returns, the lives of no less than three men are lost by accident for every £100,000 value of work carried out. The strange thing in regard to the public works accidents is that they do not so often happen to men engaged in work that is known to be dangerous as in work of a more ordinary character—such as excavating in timbered trenches, traffic work on railways, quarry work, and so on. Men after a time get careless, and often run considerable risks which are unnecessary, and end in loss of life.

Then we arrive at another part of the address which will have particular interest for the gas engineer—that is, where Sir John remarks upon the injustice of an engineer, in drawing up the conditions of a contract, appointing himself sole arbiter for the settlement of disputes. There is common-sense point about this complaint of Sir John. In most cases such disputes originate through differences between the engineer and the contractor, arising very often through ambiguity in the specification. Hence such an engineer puts himself in the position of a judge of a case in which he is practically one of the disputants, the fitness of which course can bear no inquiry whatever from a fair or moral point of view. It has been argued that contractors should decline to come under conditions of this kind, and that if contractors would, in standing out against such a stipulation, only stick together and refuse to sign documents containing a clause of the nature named, they would form a combine of a very fair and legitimate kind. It may be said that with men of high character and positions, contractors are fairly safe, under the conditions complained of; but all the same, Sir John maintains that the principle is a wrong one, and in England should be done away with, as has practically become the practice in Scotland.

We cannot proceed further with our examination of the address. What we have written shows its healthy character. Sir John Jackson goes even deeper than we have indicated in his appeal to the young men of the British engineering profession to maintain its honourable traditions and its position among the nations of the world. If those who heard him will only live up to his precepts and teachings, they will be men and gentlemen; and their business careers will be creditable both to themselves and to the

profession. Sir John has done his duty in his position as President; his hearers have had theirs set plainly before them. Upon them rests the result.

CITY AND GUILDS OF LONDON INSTITUTE.

Work of the Examinations Department.

THE recently issued report on the work of the Examinations Department of the City and Guilds of London Institute, of which we have received a copy from Sir Philip Magnus, the Superintendent of Technological Examinations, is a far more bulky book than its predecessors, as, in addition to the customary matter, the whole of the questions set in the various subjects on which candidates were examined are given. Our readers are, of course, specially interested in those relating to "Gas Manufacture," which were published in the "JOURNAL" soon after the examinations were held last May. We have also given the names of the successful candidates and the prize-winners.

It is very gratifying to learn, from the report of the Examiner (Dr. Harold G. Colman), that the papers in the Ordinary Grade showed generally a very marked improvement. Many of those which secured for their authors a first-class pass were very creditable; the answers showing "an intelligent appreciation of the subject." Dr. Colman reports that in the Honours Grade the papers were not, on the whole, so satisfactory, though they were about up to last year's standard. Attention has from time to time been called to the poor character of the sketches accompanying the answers. There has now been some advance in this respect, probably owing to the greater length of time allowed for the examination; but Dr. Colman says there is still room for much improvement. He advises the candidates in both grades to practise illustrating their answers by rough sketches. There was evidently reluctance on the part of the candidates to make drawings; for, in the majority of cases, none were put in unless they were specifically asked for. The Examiner points out that, with the aid of a sketch, the answer can often be given very shortly and clearly; whereas without one it is frequently so long and involved that it becomes difficult for him to be quite sure whether or not the candidate has correct ideas. There was a slight increase in the number of students in attendance last session, as compared with the year 1899-1900, but a marked augmentation in that of the candidates attending the examinations; the figures being 117 against 102, and 184 against 139 respectively. There was a very great difference in the number of passes in the two years; being 115 at the last, and only 64 at the preceding examination. These results are attributed in a large degree to the publication in the Technical Press of articles and letters directing attention to the examinations. Out of the 60 candidates who endeavoured to obtain honours, 16 passed first class, 20 second class, and 24 failed; while in the Ordinary Grade, 42 passed first class, 37 second class, and 45 failed. There were consequently 115 passes and 69 failures, or 37·5 per cent.

With regard to the general work of the Department, we find that, in all, 2222 classes were registered during the past session in different branches of technology, and 165 in manual training; the number of students in attendance being 36,034. In technology, 14,816 candidates, and in manual training 922 candidates, presented themselves for examination—these numbers including those examined in India and the Colonies. There was an increase of 40 in the number of registered classes, and the students attending them numbered 34,246, compared with 34,189 in the preceding year. There are altogether 70 subjects in the programme, and examinations were held in 66 of them. The number of worked papers, not including those forwarded from India and the Colonies, was 14,653, of which 8143 satisfied the Examiners. The number of certificates awarded, however, was far lower. None are given on the results of the preliminary examinations; and where a course of instruction extending over two years is prescribed for a certificate in the Ordinary Grade, such certificate is not awarded until the candidate has passed the examinations at the close of each year's course. The attention of managers, teachers, and students is specially directed to the extracts given from the reports of the Examiners, which deal fully with the causes of the failures recorded, though these were only 0·2 per cent. higher than those of the year 1899-1900. The reports of these gentlemen show that the general education of a large number of students who enter the technological classes is still defective, and that consequently they are unable to profit as they should do by the special instruction they receive. Complaint is made of the want of skill in drawing, and of the absence of elementary scientific knowledge, on the part of the candidates. To provide a partial remedy for this defect, the Institute has arranged its preliminary courses of instruction and its corresponding examinations; and students are strongly advised to attend them before proceeding to the study of the technology of their subject. Another point to which attention is called in explanation of the high percentage of failures in certain subjects (84·9, for example, in electric lighting and practical wiring) is the fact that many candidates succeed in passing either the written or the practical test, but are unable to pass in both. "Technical instruction fails altogether of its purpose," says the report, "if the student does not understand the 'why' and the 'wherefore' of the operations he performs. The aim of such teaching as is given in technological classes is not to make expert workmen, but to show how difficulties may be overcome, and how skill in drawing and a knowledge of the principles of science may, with sufficient practice, help to produce expert workmen. It is not the object of the Institute's examinations to test mere skill in workmanship. The craftsman's own work is the best certificate he can produce. But, as evidence of training in the principles underlying the practice of his trade, the class certificate in technology has a distinct and recognized value."

Our readers will probably remember that the programme for the examinations to be held next year was published some months ago, in order that arrangements could be made for the commencement of the studies in good time. Those, however, who desire general information in regard to the subject for future use should procure a copy, or of the report above noticed, either of which can be had post free by sending 1s. to Messrs. Whittaker and Co., of Paternoster Square, E.C.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1257.)

FOR the second week running, the Stock Exchange has had a five-day week; the Exchange being closed on Saturday on account of the Lord Mayor's Show monopolizing the thoroughfare. The resulting inconvenience to the markets, however, was not great, business being so quiet. The ruling tendency at first was dull, owing to South African affairs, the Franco-Turkish difficulty, and the foggy weather. But later on there was a pronounced reaction; and things in general became more cheerful. The Money Market became rather easier, and then dropped into a settled condition. In the Gas Market, business was a good deal quieter than it had been the previous week. For the first day or two, there was hardly anything at all doing; but afterwards dealings brisked up a bit, and redeemed the week from practical barrenness. The prevailing tendency was steady to a marked degree, prices ruling level all through, and hardly any alteration occurring in quotations. In the issues of the Metropolitan Companies, there was no change at all. Gaslight ordinary was rather inanimate at first, but soon livened up, and became active before the close. Transactions every day were at very level prices, never ranging more than a fraction above or below 98—just as they had been the preceding week. The secured issues were quiet, and equally unmoved. In South Metropolitan, business was very limited; bargains being at the rate of about one a day. One single deal in Commercial sums up the total of the week's operations. The Suburban and Provincial group was more interesting and animated. Crystal Palace was much dealt in, and at good prices; and several other issues came in for attention. In the London market, the only change was a reduction in Southampton. Locally, however, Bristol was a shade harder, but Newcastle, which was standing at very high figures, had to come down. Very little was done in the Continental Companies, and there were no changes in price. Firmness was the rule; and Imperial left off with a mark at top price. The remoter undertakings were almost destitute of any feature, though Melbourne 5 per cent. bonds advanced a point. Transactions in the Water Companies were on a very quiet scale. The London County Council have resolved yet once again to fling away the ratepayers' money in another attempt to induce Parliament to constitute them the Water Authority; but the market is now so used to these outbreaks that their recrudescence disturbs it not.

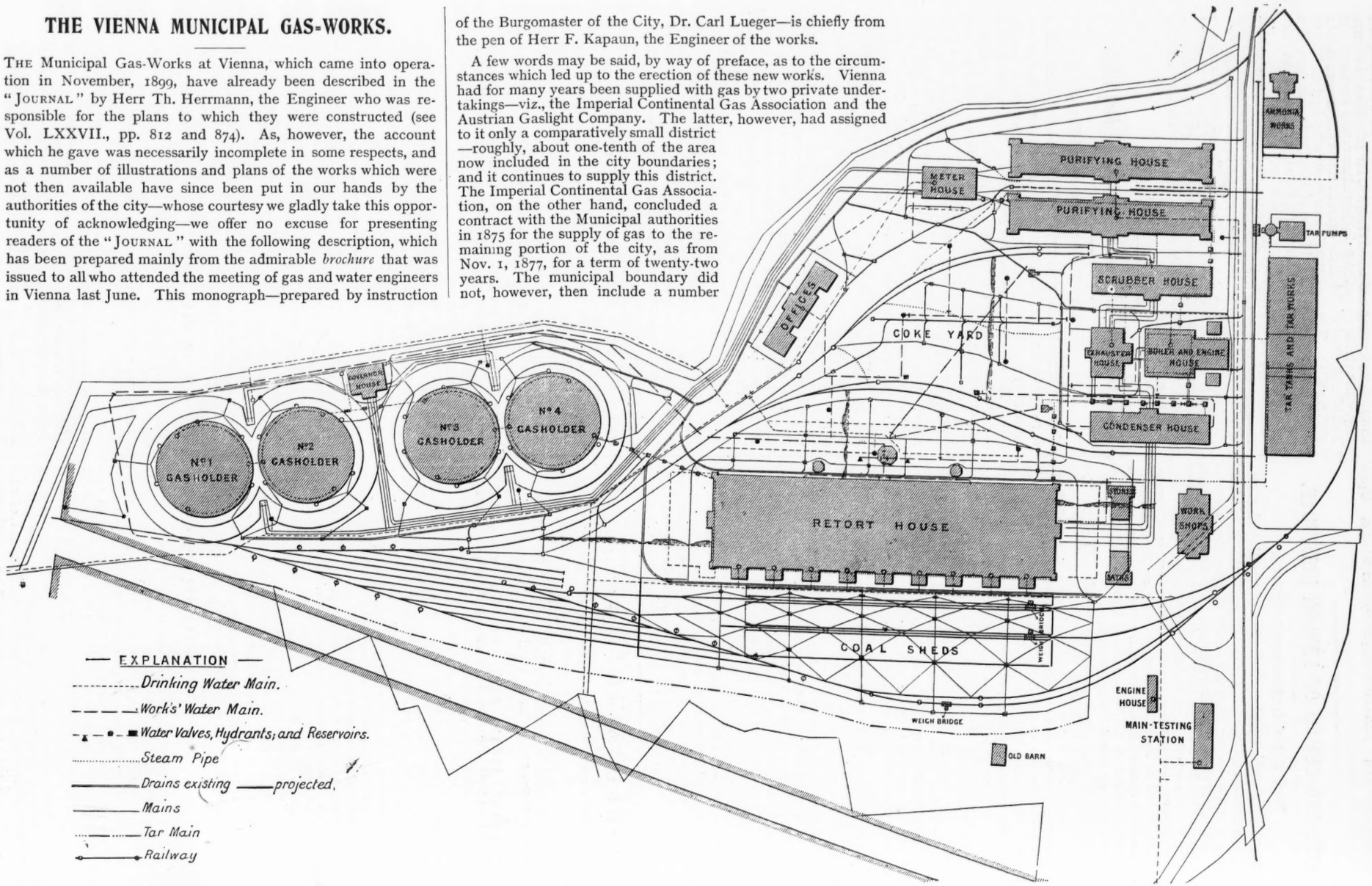
The daily operations were: Very quiet business in Gas on the opening day. Southampton fell 3. Tuesday was quite as slack, but Wednesday produced more activity. On neither day was there any change in quotation. Thursday was a moderate day. Melbourne 5 per cent. bonds rose 1. In Water, West Middlesex receded 2½. Friday was active, but unchanged; and Saturday the Exchange was closed.

Sunday Labour in Gas-Works.—Readers of the "JOURNAL" are aware that Mr. R. G. Shadbolt, of Grantham, has displayed great interest in the question of the reduction of Sunday labour in gas-works, on which, it may be remembered, he read a paper at the meeting of the Manchester District Institution of Gas Managers this time last year. Being desirous of gauging the progress made, and of bringing the statistics quite up to date, Mr. Shadbolt has complied with a request submitted to him by several gentlemen associated with this movement, and forwarded to his professional colleagues a circular containing a few questions bearing upon the matter. The points on which he would be glad of information are whether they have effected any diminution in Sunday labour in their works, particularly in the carbonizing department, and to what extent; and whether, assuming the character of the plant or the local conditions are such as to prohibit stopping on Sundays, they are in favour of the movement, and, if not, to give their reasons, with any additional remarks which may be at all helpful. We have from time to time condemned the practice of attempting to elicit details of manufacture and professional practice by means of the obnoxious "inquiry circular." Here, however, we have to deal with a very different matter. Mr. Shadbolt is engaged in a philanthropic work in which he deserves the cordial support of his fellow-managers; and we trust that appreciation of his efforts will be shown by a ready response to his application.

THE VIENNA MUNICIPAL GAS-WORKS.

THE Municipal Gas-Works at Vienna, which came into operation in November, 1899, have already been described in the "JOURNAL" by Herr Th. Herrmann, the Engineer who was responsible for the plans to which they were constructed (see Vol. LXXVII., pp. 812 and 874). As, however, the account which he gave was necessarily incomplete in some respects, and as a number of illustrations and plans of the works which were not then available have since been put in our hands by the authorities of the city—whose courtesy we gladly take this opportunity of acknowledging—we offer no excuse for presenting readers of the "JOURNAL" with the following description, which has been prepared mainly from the admirable *brochure* that was issued to all who attended the meeting of gas and water engineers in Vienna last June. This monograph—prepared by instruction of the Burgomaster of the City, Dr. Carl Lueger—is chiefly from the pen of Herr F. Kapaun, the Engineer of the works.

A few words may be said, by way of preface, as to the circumstances which led up to the erection of these new works. Vienna had for many years been supplied with gas by two private undertakings—viz., the Imperial Continental Gas Association and the Austrian Gaslight Company. The latter, however, had assigned to it only a comparatively small district—roughly, about one-tenth of the area now included in the city boundaries; and it continues to supply this district. The Imperial Continental Gas Association, on the other hand, concluded a contract with the Municipal authorities in 1875 for the supply of gas to the remaining portion of the city, as from Nov. 1, 1877, for a term of twenty-two years. The municipal boundary did not, however, then include a number



of outlying districts, which have since been brought within it; and with many of these districts the Association made contracts terminating at a later date than the contract with the Municipality. When these districts were absorbed in the municipal area, the Association maintained its right to supply them for the full terms of the contracts made, without regard to the earlier termination of its contract with the Municipality. The authorities of the city had the option of terminating their contract under certain conditions at the expiration of twelve years—*i.e.*, in 1889; but though the question of the purchase of the Association's works or the erection of new works at that time was much discussed by them, the contract was ultimately allowed to run for its full term of twenty-two years—terminating on Oct. 31, 1899.

Many years prior to this date, negotiations were entered upon for the purchase of the works of the Association by the city, from that date; and at the same time, projects for the erection of completely new works were discussed in the City Council. There appeared to be a consensus of local opinion that the time was ripe for the undertaking of the gas supply by the municipal authorities; and the question of a renewal of the contract with the Imperial Continental Gas Association for a further term of years was not seriously entertained. Ultimately also the purchase of the Association's works and mains was decided against; and in October, 1896, the city authorities definitely determined to erect new works and provide new mains for the supply of the area served by the Association from the date of the termination of the existing contract—*i.e.*, from Nov. 1, 1899. The existence, however, of independent contracts, terminating at a later date, between the Association and districts which were at one time outside the municipal boundary, but had since been brought within it, led finally to an understanding between the Association and the city authorities. In effect, it was agreed that, in consideration of impending litigation being dropped, the Municipality would leave to the Association unquestioned the right to supply gas, until the close of the year 1911, in the outlying districts on the west and north-west of the city. The Municipality, however, would undertake the supply of the central and eastern portions of the city from Nov. 1, 1899. The district supplied by the Austrian Gaslight Company, in the south-west, was unaffected by this arrangement.

In order to make clear the effect of this division of the gas supply from Nov. 1, 1899, it may be well to point out that the city of Vienna now comprises twenty districts. The first is the Inner Town, in the heart of the place. This first district is encompassed by eight districts—viz., the second to the ninth districts inclusive. To the south-east, and lying outside this first circle, are the tenth and eleventh districts, in the latter of which the new Municipal gas-works are situated. To the north is the twentieth district. The whole of the twelve districts named are now supplied with gas from the new works, which therefore already have a distributing system extending throughout the more central districts of the city and three of the outlying districts. The remaining eight districts—all lying outside the first circle of the more central districts—are at present shared by the Imperial Continental Gas Association and the Austrian Gaslight Company; the greater part of the area comprised therein being in the hands of the former undertaking. The Municipality, however, have in comtemplation the supply of these districts also from their new works as soon as the terms of the present contracts expire—at the end of 1911 in the case of the Imperial Continental Gas Association's area of supply. The new works and the new distributing system of the Municipality have, therefore, been planned with a view to the future extension of the supply to the whole of the municipal area. Already they supply practically all the area which was included within the old municipal boundary, prior to its extension about ten years ago. The works are thus destined to ultimately take the place of the whole of the six works from which the Imperial Continental Gas Association supplied the city. Some of these have already fallen into complete disuse—notably the Erdberg works on the west bank of the Danube Canal.

In the foregoing account of the manner in which the present position of the gas supply of Vienna has been brought about, we have purposely refrained from discussing the rights and wrongs of the questions at issue between the Imperial Continental Gas Association and the Municipal Council. They have been dealt with as current topics in the "JOURNAL" as they arose; and any discussion of them would be foreign to our present purpose, which is to give our readers a succinct account of the new gas-works, with some references to the magnitude of the gas undertaking of the Municipality.

The idea of one large central works for the supply of gas to Vienna and the surrounding district is not new. It has for years appealed to the imagination of the citizens, who one and all seem imbued with an intense sense of the high destiny of their beautiful city. It was obviously out of keeping with this sense of civic loyalty that the gas supply should remain in the hands of English capitalists. But a project for Municipal gas-works when brought forward in 1872 was premature; and it was really only after the engagement of Herr Herrmann in 1893 as Consulting Gas Engineer to the Municipality, that such a project took definite shape. Herr Herrmann practically proposed the construction of works for an annual output of 3500 million cubic feet on the site of the present municipal works. He contemplated the erection of such a works in four independent sections; and the scheme ultimately adopted was substantially his. But it was not until the end of October, 1896, that the Municipal Council decided on the erection of new gas-works, and the laying down of a new distributing system, to come into operation on Nov. 1, 1899. There were thus exactly three years for the completion of the work. Plans had still to be discussed and settled before the work could be actually commenced. A Committee were entrusted with full powers to carry out the whole of the undertaking in the most expeditious manner. On it sat the Burgomaster and other leading civic officers, with Herr F. Kapaun as Constructing Engineer, and Herr Th. Herrmann as Consulting Gas Engineer. The plans of the latter had included *façades* of glazed bricks throughout; but the Committee were compelled to give up this portion of his scheme, on account both of the difficulty of obtaining enough of such bricks in the time at disposal, and of the great cost. The whole of the plans had to be subordinated to the condition that the works and distributing system should be finished, tested, and ready for regular work, within three years.

The site selected for the works was some low land within the municipal boundary, on the eastern side of the city, and about three miles from the centre of it. The main line of the Austro-Hungarian State Railway runs along one side of the land, and the municipal electricity works are now in course of erection on the other side of the railway line. The land abuts on the west bank of the Danube Canal, some distance above the point where it emerges into the Danube. The canal, however, is of little service to the gas-works, owing to its rapid stream and the still more rapid stream of the Danube itself. The coal supplies are brought to the works entirely by rail—the line which runs alongside being in direct communication with the coalfields of Austria. The area of the site is nearly 71½ acres; but, as the plan shows, it is of awkward shape, and, moreover, is traversed by the main-sewer for the eleventh district, which runs parallel to the railway, at about 110 yards from it. This could not be built over. Hence the original plans had to be modified, and the buildings arranged as best suited the awkward site. The four gasholders and governor house were, therefore, put on the tongue of land towards the city; and the rest of the ground was roughly divided into two halves by the retort-house, to the south of which were put the coal-sheds, pipe-stores, &c., and to the north the various machinery and purifying houses. A space was also left on this site for the coke-yard. Between the railway and the sewer, it was decided to sink the tar and ammonia wells, and erect the sulphate works.

The site was very low lying land; and, in order to avoid risk of its being flooded, it was necessary to raise the surface level by 5 feet on the average, and in some places by over 6 ft. 6 in. For this purpose 513,000 cubic yards of filling material had to be carted on to the site. This was a matter of some difficulty, as it had to be done while building was in progress, and the works' mains and drains were being laid. It was hoped that the material could be obtained from dredging operations on the Danube; but, in the end, it was found necessary to procure it from different parts of the city, and to bring it to the works in carts. A track of standard gauge was at the outset laid on to the works from the branch line leading from the State Railway to the Erdberg works of the Imperial Continental Gas Association; and by this means all the materials required for the erection of the new works were brought on to the site.

Provision had to be made for bringing on to the works, and storing, the necessary supplies of coal as required. The most suitable gas coal is obtainable from the coalfields of Ostrau and Karwin, in Moravian Silesia. The annual requirement of about 290,000 tons was intended to be supplied, by arrangement with the colliery proprietors, in about equal monthly deliveries. But it was necessary, in order that emergencies might be met, to provide storage accommodation on the works for the whole of the probable consumption during the months of November, December, and January—that is to say, for about 100,000 tons. The transfer of the coal from the State Railway line to the works was greatly facilitated by the fact that the line here is about 19 ft. 3 in. above the level of the gas-works. Herr Herrmann's original scheme provided for an elevated railway running from the State line through a coal-storage house built alongside the retort-house. But the great cost of such an installation, and a desire to have greater choice in the manner of storing coal, and to avoid risk of fire spreading through it, led to this scheme being abandoned in favour of three sheds completely open at the sides and railways on the yard-level. An incline of 1 in 50 connects these with the State Railway line. At the foot of the incline, the line diverges into four tracks, two of which run between the coal-sheds, while the others pass at the back to a shunting yard having twelve tracks, from which lines lead to the coke-yard and other parts of the works. The total length of the railway lines on the gas-works is some 6640 yards. Arrangements have been made with the State Railway for dealing with the gas-works' traffic; and the scheme of lines on the works has been carried out accordingly. On the average, 63 trucks of coal are received daily at the works; but on some days the number has been as many as 160. The coal-sheds referred to have a total covered area of 9050 square yards, which is only about 20 per cent. of the area needed for storing the supply in question. The remaining coal is stacked in the open, in heaps 16 to 21 feet high; and the area thus occupied by it is about 36,000 square yards. There is ample space for an extension of the coal-yard. Coal is conveyed from the store-sheds and heaps to the coal-breaking machines by means of a tramway of 24-inch gauge.

The municipal authorities have provisionally disposed of their

make of coke by contract; and the breaking and sorting of the coke has, therefore, been left to the contractor, who has erected sets of breaking and sorting machinery in a temporary building. One set is driven by steam, the other by direct current—both supplied by the Municipality. The installation, however, must be regarded as only provisional, for the reason that it was thought best to defer making definite arrangements for dealing with the coke, and also to refrain from introducing machinery for conveying coal and coke until the extent of the requirements and the conditions had been fully realized by a few years' practical operation of the works. The experiences gained since work started are said to confirm the wisdom of this view. So, for the present, some of the most interesting adjuncts of a modern gas-works are lacking at Vienna; and it was this fact mainly which led the correspondents of the "JOURNAL" who visited the works in June last to describe them as being on the whole singularly disappointing. If the talked-of installation of coal and coke conveying plant, &c., had been already introduced, their adverse opinion would probably have been considerably modified.

(To be Continued.)

LIBERTY AND LABOUR.

IT IS not an uncommon occurrence to find those who at one time were zealous advocates of a general principle, of ethics or politics, at another carefully ignoring, or actually contending against, that principle because its application to the existing circumstances is not so convenient as in former days. The man who, when he was an employee in poor circumstances, was a red-hot believer in the equality of all, does not always retain that faith when the tide of fortune has carried him to the position of a well-to-do employer. The views of a man earning £200 a year as to the policy of a graduated income-tax are not as the laws of the Medes and Persians; they are liable to modification by the addition of a nought to the annual income. "Circumstances alter cases."

No exception to this rule is found when we consider the former and present attitudes of the "friends of labour" towards the ideal summed up in the word Liberty. In days gone by, when a Trade Union had no existence in the eye of the law, when a combination of workmen to bring about a strike was a conspiracy, punishable at law, or when any combination of workmen for their own protection was unlawful, the sacred name of Liberty was freely invoked by those who were desirous of seeing legislation instituted in order to place workmen and their organizations on a different footing. "Personal liberty" was infringed, it was pointed out, if one individual was not permitted to combine with another to do that which he was at liberty to do by himself—for example, to refuse to work for less than a certain wage or under certain conditions.

The argument was admitted; the principle of personal liberty was upheld, and the legislation of 1875 ensued. Now mark the sequel. Trade Unions having climbed to the desired position by the ladder of Liberty, that sacred principle has been—in effect, if not in word—discarded. One man may combine with another to leave a job—that is liberty. But another man must not take the discarded job—that is being a blackleg. Nor must he do as much work as he can in order to earn as large a wage as possible—that being against the laws of political economy as understood by the Trade Union. No greater enemy to personal liberty exists, in fact, than that which owes its present position and rights at law to the Englishman's love of freedom—namely, the Trade Union. That is a truth to which we hope the public in this country is waking, slowly, but not the less surely.

Because of the very great importance of the question to the nation's commercial future, and because the instruction of public opinion as to the rights of the matter is a difficult task—one that must be carried out doggedly and with patience—we welcome most cordially the publication in the "North American Review" for October of an article by the Reverend John Ireland (Roman Catholic Archbishop of St. Paul, Minnesota, and a well-known figure in American public life) on "Personal Liberty and Labour Strikes." The article is written, not merely to deal a blow at the tyranny of Trade Unionism, which has reached a scandalous point on both sides of the Atlantic, by calling public attention to the injustice of its methods, but, further, to demonstrate that injustice to the individual members of the Unions who, through their organizations, are guilty of the tyranny, in order that, in their own interests, they may be induced to mend their ways. The Archbishop says:

> To condemn the abuses against personal liberty which have marked the course of strikes in this and other countries, is to serve the cause of labour and of labour unions. The most praiseworthy cause may be ruined by the adoption of methods that reason and religion reprobate. Public opinion will not long tolerate what conduces to lawlessness and anarchy; it will put the ban upon associations which, however legitimate their purpose may be, tend to undermine law and order in society. The purpose will be forgotten in presence of the methods. Under the pressure of evil methods, associations will inevitably suffer disintegration. Conscience and patriotism are alive in the bosoms of the men who constitute associations; conscience and patriotism rise higher than allegiance to any association. The cause of labour is of itself so holy, that all right-minded men, all Christians, must lend to it their sympathy and support. It is the cause of humanity; it is the cause of religion. Why should it not in its onward march so bear itself that no censure can attach to it, that no friend must be obliged to withdraw from it his esteem and his love?

That the methods adopted by Trade Unions are open to severe censure, the Archbishop very clearly shows in the course of his article. We only wish his exposure of them in their true light would arouse the "conscience and patriotism" of the individual members of those Unions; but we cannot confess to optimism in the matter. It is indeed truth that the conscience of the working-classes needs to become more active before they can regain the esteem of those who are their friends in a far truer sense than are those who are so fond of posing as such. But the dishonest and dishonourable doctrines of Trade Unionism have so deeply overlaid that conscience that it requires a shrewd cut to reach the quick. This sounds, perhaps, a harsh saying; but it is not merely employers and their friends who testify to its truth.

In proof of this, we need but refer to the letter addressed not long since by Mr. Bramwell Booth to "The Times" (see *ante*, p. 1046), in which he said:

> What I wish to point out is that this question [the restriction of output] is not only an economic and commercial, but a moral question. Whether or not the tacit understanding which so largely prevails, that no workman should attempt to do all he can for his employer in the time which he has agreed to sell to that employer, is in the end commercially profitable to that workman or to workmen as a whole, it is, I venture to think, a violation of the law under which moral beings are associated, and a perversion of the true social order. And from my own observation I am led to believe that it is only too often followed by the most unfortunate consequences to the manhood of the worker. It tends to dull his moral sense, to dwarf his idea of what is honourable, to commit him to a course of "eye service," which is really cunning and trickery, and when it finds congenial soil in weak and truculent natures, ultimately reduces him to little more than a *highly specialized cheat*, intent upon appearing to give a full honest return for what his employer pays him, while careful above all things, to do nothing of the kind.

The phrase italicized should stick. It will not please our Trade Union friends to be called highly specialized cheats; but the sooner the public realizes the accuracy of the description, and the fact that the practices of Trade Unionism dull the moral sense, destroy the honour, and tarnish the manhood of the working classes, the better. But it will be a long time before those truths can be brought home to the men themselves, deluded as they are by the fulsome and dishonest flattery of those organs which invariably proceed upon the assumption that "the men" are always right, and the capitalists (usually described as "bloated") are always wrong.

The attitude of these organs, and of labour politicians and "leaders" generally, towards the question of the personal liberty of the individual, savours, however, rather of hypocrisy than of dishonesty. When an employer requires a man to sign a contract of service (for example, the agreements made between the South Metropolitan Gas Company and their profit-sharing hands), that is seeking to curtail his personal liberty—he cannot strike if he wants to (though he need not sign the agreement). But when it is the Trade Union who wish to keep every man's output of work down to a dead low level and to prevent any one man distinguishing himself if he would, the sacred cause of Liberty falls into the background. Liberty and Trade Unionism mix about as well as oil and water.

Archbishop Ireland deals principally with the violations of personal liberty which not infrequently—one may almost say, invariably—attend strikes organized by unions, instancing especially the recent intimidation of the many hundreds of men wishing to work, but prevented from so doing, at the mills of the Amalgamated Steel Association in America. The tale is a familiar one—the approaches to the mills picketed by relays of strikers; non-union men set upon and forced to retreat for fear of bodily injury; those who by stealth or ruse reached the works, obliged to remain for fear of violence; men known, or supposed, to be non-unionists stoned in the streets, the police powerless to protect them; non-unionists kidnapped and locked up in empty store-houses; and so forth. "In these and similar incidents the sufferers were not merely those who were the immediate victims of violence and of intimidation, but also the much larger number of people throughout the country who, were it not for the menace and injury that awaited them, would have come forward and obtained employment. . . . Such acts," adds the writer, "I assert we cannot too strongly reprobate; nor can we, for the sake of public order and of personal liberty, be too zealous in awakening public opinion in condemnation of them."

These acts are indeed, as is pointed out, utterly lawless; but that fact is all too seldom realized by the public, or acted upon by the authorities responsible for the maintenance of law and order. Various enactments, by individual States, are quoted by the Archbishop, who adds:

> The principle which underlies these and similar laws has been admirably enunciated by a judge of the State of Massachusetts—"Freedom is the policy of this country; but freedom does not imply a right in one person, either alone or in combination with others, to disturb or annoy another, either directly or indirectly, in his lawful business or occupation, for the sake of compelling him to buy his peace." Such acts of violence and intimidation as are covered by the enactments and decisions quoted are, for the most part, far less detrimental to personal liberty than those that have been happening under our own eyes. More strange still is it that such things are tolerated by State authorities who are either unwilling or unable to repress them!

It is not, unfortunately, only in America that this slackness of the authorities—a reflex, possibly, of the slackness of public opinion, misled by prating demagogues and well-meaning but

mischievous philanthropists—is to be witnessed. As Professor Case pointed out the other day, our Board of Trade is willing to use its powers of "conciliation" or "arbitration" with cynical indifference to the fact that criminal violence has been done by the men on strike. "When one contemplates the criminal violence which has attended disputes so near together as that on the Taff Vale Railway in South Wales, that at the Penrhyn Quarries in North Wales, and that now proceeding [Sept. 28] in the East of England at Grimsby, one cannot help asking this question: 'How is it that those who commit these crimes think that the dispute will nevertheless end in their favour?' It is because they expect, on the one hand, to escape punishment, and, on the other hand, to recover their places by conciliation or arbitration of some kind." But then the officials of the Labour Department of the Board of Trade were, some of them, nurtured in the faith that "the men" have a vested interest in the berths they have voluntarily vacated; and that belief smokes the glass of the telescope when it is turned upon acts of intimidation or violence. We would commend to the consideration of those higher in authority than the said officials, Archbishop Ireland's definition of their duty—

> The duty of the State in the presence of strikes is clear and imperative. It is to protect personal liberty in all cases, and at all costs. The entire authority of the State should, if necessary, be put in motion to protect the liberty of a single citizen, whether that citizen be one who refuses to work or one who desires to work. . . . The law should mercilessly put down intimidation and violence, whencesoever they come. Its action should always be directed towards the freedom of the individual, be he workman or employer, unionist or free labourer. The refusal or the failure of the State to repress and punish violations of personal liberty is the introduction of anarchy. . . . If strikes necessarily require as a condition of success the violation of personal liberty and the subversion of social order, then strikes stand self-condemned.

The Archbishop makes short work of the sophistical plea that, a strike being in the nature of a war, intimidation and compulsion of those desirous of working are justifiable as measures of war, necessary to its prosecution. Such arguments, he says, make for the undermining of the structure of civil society. "Private citizens, or associations of private citizens, have no right to institute war; this is the exclusive right of public authority." That is a point worthy of note. No one is at liberty to take the law in his own hands—which is what Trade Unions often do.

With one more quotation from this admirable article, which we recommend all who are interested in the subject of the relationship of the labourer to his employer to read in its entirety, we must conclude:

> A man's right to work is one of the most intimate rights of his being. It is the right to the exercise of his mental and bodily faculties. It is more—it is the right to his life, which depends for sustenance on the fruits of his labour. It is, for the same reason, the right of his wife and children to their lives. Of this right no man can, with any shadow of equity, deprive another. Neither can any man by his own authority dictate to another when and how this right is to be used; else this other were his subject, his slave. And when, in order to deprive a man of this right, violence is done to him and bodily injury inflicted, then there is no measure to the injustice put upon him; all semblance of liberty is effaced; physical force becomes the ruling law in the relations of man to man.

What no man can, with any shadow of equity, do, no combination, no union, of men can do. The rights of the union cannot exceed those of the individuals. Let Trade Unionism be judged by that fundamental law which was invoked on its behalf in bygone days—the law of man's right to his personal liberty, restricted only by regard for the liberty of others.

ELECTRIC LIGHTING MEMORANDA.

Talking over the Electrification of the Underground Railways—The Alternatives—Yerkes Intervention—Question of Electrolysis.

When people who are under an obligation to live together discover that one or the other has something on his or her mind which has the objectionable effect of making friction in the domestic arrangements, a very popular prescription for eradicating the source of the "unpleasantness" is to "talk it out." In cases where the difficulty is known to be of a serious nature, and complications are dreaded, it is not unusual to hold a "family council" for the investigation of the cause, and, if possible, for the composing of the difference by the weight of benevolent and interested advice. Something very like this might be taken for one view of the so-called "private arbitration" on the question of the electrification of the underground railways of London, which has been going on all last week. The Metropolitan, and the Metropolitan District Railway Companies are a not very well assorted couple, who must nevertheless make the best of their joint business in the tunnels and deep cuttings which contain the "Inner Circle" railways round the centre of London. They have been driven to a common extremity by the competition of the Central London electric line; and they are both agreed upon the point that they must have an electric service as well, if they are to keep a profitable amount of passenger traffic. Beyond this common ground, however, there is no agreement. Parliament has wisely ordered that whatever the two Companies do, they must do alike or together, at any rate so far as the Inner Circle is concerned. This is so obvious a necessity of the case, that the principle underlying it must have been followed in any event.

There probably would have been agreement between the Companies on a common plan of action before this, if they had been left alone to work out their destiny. But it was not to be. The Companies are very differently situated financially; for whereas the Metropolitan Company, the senior partner, can command ample resources wherewith to go marketing for whatever they may require, the Metropolitan District can only live from hand to mouth and have no capital to spend. The latter Company, therefore, were marked out by the ambitious American railway "boss," Mr. Yerkes, as an easy victim for the operation of getting control of the voting power of the proprietary by purchase of the majority of the ordinary stock. This done, the way was clear for committing the railway to the adoption of the particular method of electrification favoured by the new controllers, which happens to be the same system as that actually employed on the Central London line. It is the direct current system, as applied by the British Thomson-Houston Company. The main features of this system are the use of a current at the standard tramway traction pressure of 550 volts. There is nothing experimental about the system, or the plant. It is all as sound and settled as anything of the kind can be, at the present time. This is its chief recommendation, which has been pressed during the arbitration for all it is worth—this, and the presumed innocuousness of the direct current at the named voltage. Unfortunately, the Yerkes plan comes out at a very high figure, both first cost and for running expenses. Now the Central London line does not work for less than 60 per cent. of the receipts, which is higher than the actual cost of the Metropolitan service.

This question of cost is the strength of the opposing Metropolitan position. They contend that in the newer Ganz system, using high power transmission and three-phase current, they can get the same service as the Thomson-Houston at a saving of at least 30 per cent. all round. This is what the Metropolitan can do in the open market, going with money in hand; and it is what would have been installed and at work by now, if Mr. Yerkes and his associates had not put their finger into the pie. What did they put it in for? Clearly with the desire to follow the bright example of Master Jack Horner in the nursery ballad; and they look to the arbitrators not to disappoint them of their wishes. It will be not a little surprising if they are gratified. They are committed to a financial "deal;" while the Metropolitan only contemplate a commercial transaction. Why cannot the Thomson-Houston Company compete with Ganz and Co. without the expensive intervention of Mr. Yerkes? The more the subject has been gone into before the Arbitrators, the clearer it has appeared that the real differences between the two systems do not account for more than a small fraction of the difference of price The things that the two tenders cover in common are more than those which are irreconcileable. The provision of motive power must be the same, the trains must be similar, and only in the cables and the so-called locomotives can there be any material differences.

The Central London Railway is not absolutely perfect. The electrical equipment at starting was none of the best; and the design of the locomotives has had to be completely changed to remove the objectionable vibration. The Company are also in continual difficulties about the smoke from the chimneys at their generating station. They were fined last week, and will be fined more heavily in future, if they do not learn how to stoke their boilers better. Then there is the unsolved question of electrolysis. Nobody can tell as yet what becomes of the percentage of unaccounted-for current on these direct-current railways. The management will not say how much it is. It seems to be pretty clear, however, that the quantity of electricity lost from the Central London and its feeding tramway lines is considerably in excess of all that is actually being manufactured expressly for electrolytic purposes in the factories where they do these things intentionally. We shall be hearing by and by of somebody patenting a scheme for utilizing the waste electricity from railways and tramways for some industrial purpose. Meanwhile, what is it doing in the subsoil? That is a question which it is greatly to be hoped will not be answered some day by a grave catastrophe. It is impossible to regard without uneasiness the prospect of an enormous multiplication of this risk by the equipment of the Inner Circle and all the branch underground railways with electric traction after the fashion of the Central London. If the two systems are otherwise equal, the relative liability to cause electrolytic injury outside the conductors ought to be considered in judging their suitability for London.

Water-Pipes Damaged by Electrolysis.—We learn from the "Municipal Journal" that the damage caused to the water-pipes in Dallas (Texas) by electrolysis is so great that the officials fear lest an important section in the business portion of the city will soon be entirely destroyed. It appears that the strictest regulations as to the prevention of damage to pipes were imposed upon the street car company when the pavement in an important street was laid; but it was not long before leaks began to show themselves in the mains, and upon investigation it was found that they were due to the current escaping from the trolley wire. The Mayor is to make a thorough inquiry into the matter.

UTILIZATION OF BLAST-FURNACE GASES FOR PRODUCTION OF POWER.

(Second Article.)

The Oechelhaeuser Gas-Engine.

The gas-engines which have hitherto been successfully applied to the utilization of blast-furnace gases for the production of power on a large scale, are of only two or three types. As already pointed out in the previous article on the subject (*ante*, p. 833), the engine invented by Herr W. von Oechelhaeuser, whose name is well known to all gas men as the Managing Director of the German Continental Gas Company, is perhaps the most interesting, as it is certainly one of the most successful of these types. It has not been so fully treated in the English Technical Press as, for instance, the type of engine now being exploited by the Cockerill Society; and hence the following account of it will not be out of place.

Fig. 1 gives vertical and horizontal sectional views of the Oechelhaeuser engine. There are two pistons, K_1 and K_2, which move in opposite directions; so that at one moment the piston-heads come near one another, and at the next are as far as possible removed one from the other. When the pistons are at their inner dead-points—that is, when the piston-heads are at their least distance apart—there is in the combustion chamber, which lies between them, a combustible mixture of gas and air compressed to 8 or 10 atmospheres pressure. This mixture is ignited by an electric spark, whereupon there ensues an increase of pressure corresponding to the calorific power of the charge, and the pistons are driven apart. This constitutes the working stroke. While the compressing and working stroke is taking place fresh air, which has been drawn in through S_L is forced out by the anterior face of the piston, which travels in the pumping-cylinder G, through D_L, to the air-chamber R_L, where it is at a pressure of 0·3 to 0·4 atmosphere above the normal. A mixture of gas and air, which has been drawn in through S_M, has at the same time been forced through D_M into the mixing-chamber R_M, and is similarly at a pressure of 0·3 to 0·4 atmosphere above the normal. At a certain point before the outer dead-points are reached, the piston K_1 begins to open the exhaust-passage C_A, so that the products of combustion in the cylinder escape, while still having a pressure of about 2·5 atmospheres, through C_A into the exhaust-chamber R_A, and then into the exhaust-pipe leading out of this, until their pressure becomes reduced to the normal. The piston K_2 at the same moment begins to open the air-passage C_L, and fresh cool air passes into the cylinder, and sweeps out into the exhaust passage

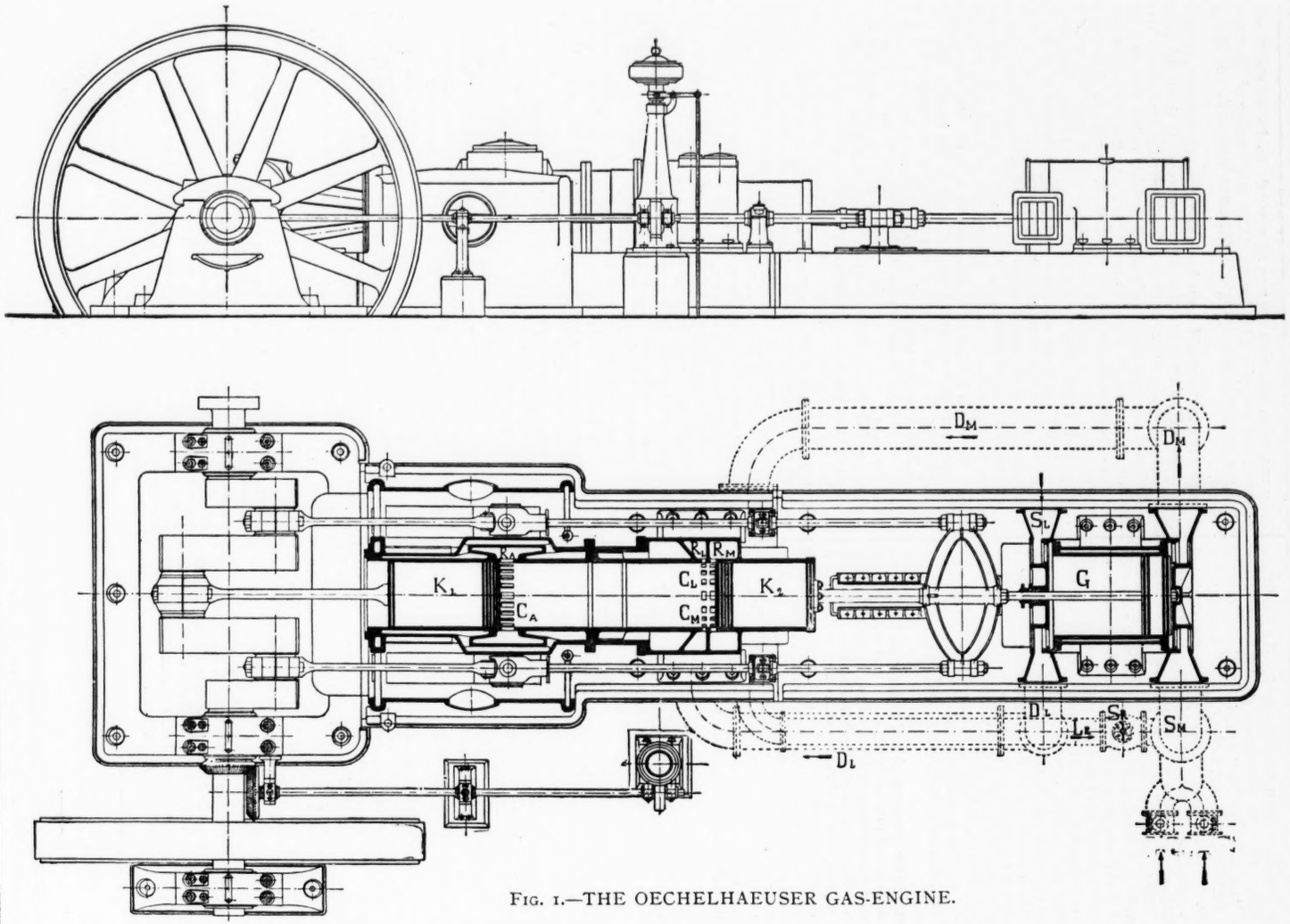


Fig. 1.—The Oechelhaeuser Gas-Engine.

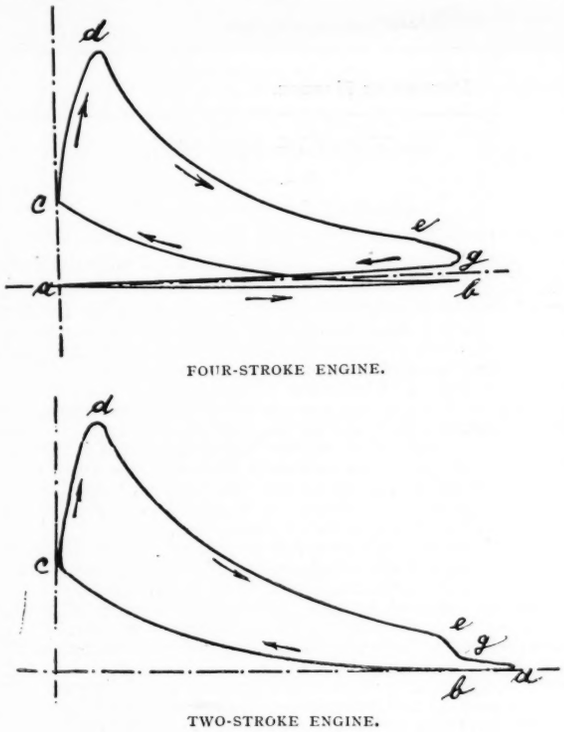
the products of combustion which remain at atmospheric pressure in it. Finally, the piston K_2 opens the passage C_M, by which the mixture of gas and air, compressed to 0·3 to 0·4 atmosphere, enters the cylinder and drives out the air before it. The pistons then again travel towards one another, and compress the mixture of gas and air which lies between them. The cycle of operations already described then takes place again.

In order to prevent the mixture of gas and air flowing out through the exhaust-passage, with consequent loss of gas, the dimensions of the cylinder are made such that the greatest volume of the mixture which is admitted at each revolution when the engine is working at maximum load only occupies about 70 per cent. of the total capacity of the cylinder. Regulation is effected by changing the proportions of the gas and air in the mixture, as well as by changing the quantity of the mixture admitted to the cylinder. The regulator therefore acts at the same time on (1) the gas-mixing cock H,

and (2) the return valve SR, which is inserted in the return pipe LR, and when open allows a portion of the compressed mixture to flow back from the pressure-pipe DM to the suction-pipe SM.

From this description, it will be gathered that the Oechelhaeuser gas-engine executes a working stroke with two pistons in one working cylinder at each revolution. The following advantages are claimed for this *modus operandi:* Firstly, the cylinder is of small diameter. For example, with an average pressure of only 4 atmospheres, the diameter of the cylinder is only $25\frac{1}{2}$ inches for the single-cylinder type of 500 effective horse power, and only $36\frac{3}{4}$ inches for the same type of 1000 effective horse power. These are about one-half the dimensions of the cylinder of a four-stroke engine of equal power. The cooling effect of the jacketting is reliable and powerful. It is far more effective in general with cylinders of small than of large diameter, because the volume of products of combustion to be cooled is proportional to the square of the diameter; while the cooling surface of the jacketting is only directly proportional to the diameter. Further, the cold air which is drawn into the cylinder supplements the cooling action of the water-jacket. Thus, even with the largest motors of this type, too high temperatures, and the attendant troubles of premature ignition and difficulty of lubricating the cylinder, are avoided. The engine thus becomes both reliable and durable.

A second advantage is found in the simplicity of the distributing mechanism, as the working cylinder has no regulating gearing, except the two pistons. With the exception of a small starting valve, which only acts during the first few strokes and then remains at rest, there is no valve-gearing attached to the cylinder. The cylinder, therefore, takes its ideal form—that of a simple



FOUR-STROKE ENGINE.

TWO-STROKE ENGINE.

FIG. 2.

cylindrical tube without any lateral chamber. Thus the combustion is completed in the most thorough manner; while there are no places in the cylinder on which dust, with which the gas may have been contaminated, can settle. If, after a long period of work, it appears at all desirable to clean the cylinder, this may be readily and quickly done merely by withdrawing the posterior piston. The almost complete abolition of delicate valve motions is highly instrumental in avoiding interruptions of work and breakdowns. A third advantage claimed for the Oechelhaeuser gas-engine lies in the machinery being well balanced. The disposition of the parts is such that their weight is evenly distributed. The parts are, as already indicated, relatively very light; and hence the framing and foundations are not required to be exceptionally substantial. The fact that the pistons work in opposite directions is of great value in maintaining equilibrium, and securing the quiet reliable action which is a characteristic of this engine, and is of such importance in all gas-engines of large size. Finally, it is claimed for the Oechelhaeuser motor that, as it is of relatively small size and of simple construction, it is very easily looked after while running, and readily kept in order. The lubrication is effected for the most part automatically; but provision is made for its control according to the observations of the engine man.

It will be seen that the economy claimed for the Oechelhaeuser gas-engine mainly arises from the fact that with it the cycle of operations is completed in two strokes instead of in four strokes, as with the now well-known Otto and Simplex gas-engines. The advantages of a two-stroke cycle are tolerably obvious; but a comparison of the diagrams of a four and a two stroke engine, as shown in the annexed figures (Fig. 2), will make them quite clear. In the four-stroke engine, the work is distributed thus: (1) A return stroke, *a b*, in which the admission of the mixture of air and gas takes place; (2) a forward stroke *b c*, in which the mixture is compressed; (3) a return stroke, *c d e g*, in which ignition, explosion, and expansion of the gas take place (this is the only working stroke); and (4) a forward stroke *g a* in which the products of combustion are expelled. The working cylinder acts as the pump for drawing in the mixture of gas and air; and consequently only one stroke every two revolutions is a working stroke. In the two-stroke engine, on the other hand, the admission of the mixture and the expulsion of the products of combustion after the explosion take place very quickly, and all but simultaneously, about the dead-point *a;* while the two strokes *b c* and *c d e*—corresponding to compression, explosion, and expansion—take place under the same conditions as in the four-stroke engine. An auxiliary pump, of course, becomes necessary for pumping the gas; but, on the other hand, the piston makes one working stroke every revolution. Consequently, the same size of cyclinder ought to correspond to about double the power which it would give in a four-stroke engine. The auxiliary pump may be placed in any convenient position near by; but in the diagram it is shown at the rear of the working cylinder, and on the same foundation with it. It is operated through a prolongation of the posterior piston rod, and is double acting.

It must be borne in mind that in gas-engines, especially those of high power, the mean pressure developed in the cylinder is very much greater than in steam-engines, and that very high temperatures are produced by the explosion. Now in a four-stroke gas-engine, in which two revolutions occur for each working stroke, it follows that the cylinder must be of large size, and the fly-wheel very heavy, in order to ensure a proper degree of regularity in working. But since the ratio of the area of the walls of the cylinder to its capacity diminishes as its diameter increases, it follows that the cooling of the walls becomes more difficult, and entails a greater expenditure of cold water, as the size of the cylinder is increased. The valves, and especially the exhaust-valve, of four-stroke engines of large size must be thoroughly cooled. The impulse is conveyed to the fly-wheel through the crank-shaft at only one stroke out of four; while the drawing in, compression, and explosion of the charge, and the expansion, act on the crank-shaft with variable force, which is transmitted to the fly-wheel and modifies its velocity. The foundation of the engine tends to be displaced in the opposite direction to that of the fly-wheel, according as the force on the crank-shaft is greater.

With small engines, it is necessary to couple up several of the four-stroke type in order to secure uniform running. The double-acting gas-engines of the four-stroke pattern, in which the explosion takes place on both sides of the piston in the cylinder, have the advantage of reduced dimensions of the cylinder. But they present some difficulties in the construction of the piston, and in keeping it gas-tight. Both faces of the piston are subject to high temperatures. Though there is a good prospect that such types of gas-engine in future will be highly developed, it seems likely that the presence of dust and solid matter in blast-furnace gases will render their maintenance in working order a somewhat difficult and expensive matter wherever these gases are consumed.

The two-stroke gas-engine of the Oechelhaeuser pattern, on the other hand, overcomes most of the difficulties which have been pointed out as more or less inseparable from the four-stroke gas-engine of large dimensions. Practically, the two strokes of the latter type, in which the mixture is drawn in and the residual gases expelled, are suppressed in the Oechelhaeuser gas-engine. Actually the expulsion of the spent gases and the drawing in of the fresh mixture take place almost simultaneously at the dead-point, and do not take up more than one-eighth of the time occupied on the complete cycle of operations. In order to facilitate the clearing out of the spent gases, the cylinder is submitted to a thorough scouring with compressed air. This plan ensures the complete cleansing of the cylinder before compression of the mixture occurs again. The pistons themselves operate the ports, and make valves and slides in the motor cylinder quite unnecessary.

In the preceding article, it was stated that, if the blowing and accessory engines at iron-works were driven by gas-engines consuming the blast-furnace gases, there would remain a surplus of these gases, after making adequate provision for their consumption in the Cowper air-heaters, equivalent to about 20-horse power per ton of pig iron produced. If the most highly efficient types of air-heaters were employed, the surplus gases would even reach the equivalent of 25-horse power per ton of pig iron. That this enormous power has hitherto been lost at most blast-furnaces is undoubtedly to a large extent attributable to the fact that the old type of four-stroke gas-engine could not be constructed with a cylinder of sufficiently large dimensions to make it of service for the cheap generation of power from the furnace gases. It was a recognition of the unsuitability of the four-stroke engine for dealing with these gases that led Herr von Oechelhaeuser to work on at perfecting the two-stroke engine until he had succeeded in raising it to its present high level of efficiency. It is simple, both in construction and management; but its chief good points, in the eyes of metallurgists, are that it affords the requisite degree of uniformity in working, and that it can be made with only one cylinder up to a capacity of 1500 effective horse power. Moreover, the blowing-engine may be coupled up direct

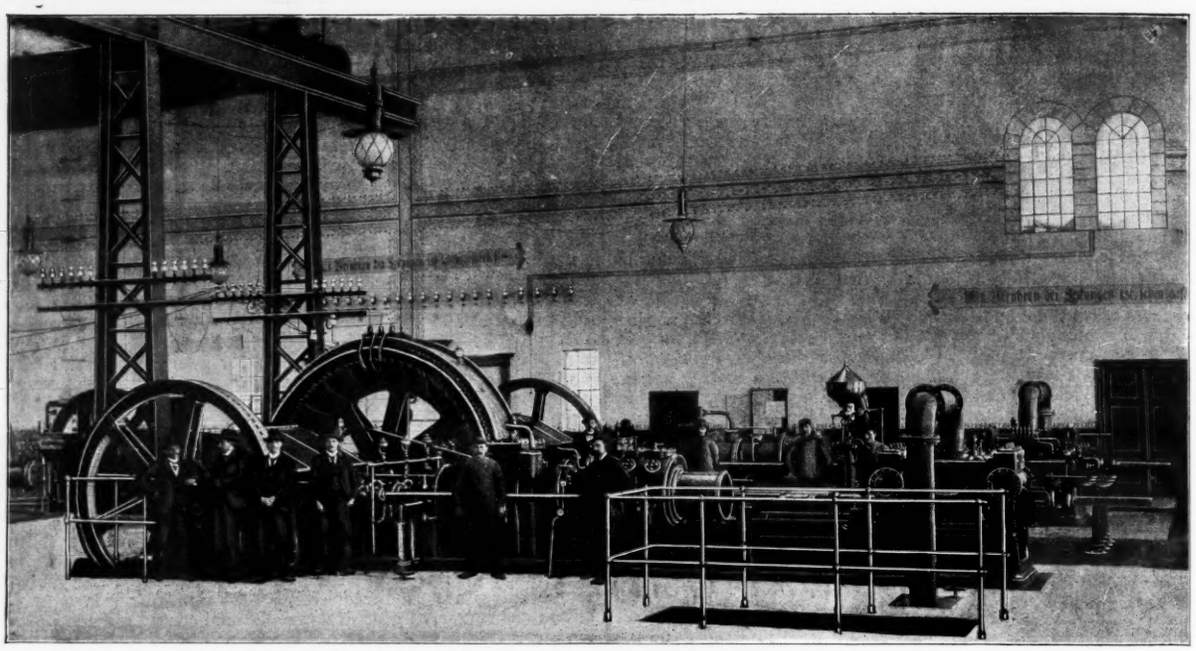


Fig. 3.—Oechelhaeuser Gas-Engine Driving a Dynamo at Hoerde.

to, and driven by, the gear which connects the posterior piston with the main crank-shaft.

In conclusion, it is interesting to note the progress which has been made in the employment of gas-engines for the utilization of blast-furnace gases since the pioneer experimental engine was tried by Mr. B. H. Thwaite, in the autumn of 1894, at the works of the Iron and Steel Company, at Wishaw. We take the following dates from a table compiled by Herr A. Wagener for a paper on "Power Gas," which appeared a short time since in the official organ of the Association of German Engineers. On the 12th of October, 1895, a 12-horse power Otto engine was started at Hoerde; and on the 20th of December the same year, a 4-horse power "Simplex" engine was put on trial at Seraing. Then followed trials, commencing on the 1st of June, 1896, at Hoerde, of a 120-horse power engine, constructed to the designs of Messrs. Oechelhaeuser and Junkers; and these were so far successful that two months later an order was placed for two 600-horse power Oechelhaeuser engines for the same works. But the first of these was not ready for work until the 12th of May, 1898; and rather earlier in the spring of that year, a 45-horse power engine had been established at the Johannis works, and a 180-horse power Cockerill engine at Seraing. By January, 1899, two 200-horse power engines, constructed at the Deutz Gas-Engine Works, had been started at the Friedens works; and by August of the same year, Messrs. Körting Brothers had erected a 100-horse power engine at the Donnersmark works. On the 20th of November, 1899, a single-cylinder 500-horse power Cockerill engine was set in operation for a blowing engine at Seraing; and in January, 1900, the second 600-horse power Oechelhaeuser engine was put to work at Hoerde. An illustration of one of these engines at Hoerde, engaged in driving a dynamo, is given in fig. 3.

From that time, a rapid increase has taken place in the number of large gas-engines established. The Cockerill and the Oechelhaeuser have been the favoured types. The extent of the orders so far obtained by the Cockerill Society was referred to in our first article on this subject; and the firms who supply the Oechelhaeuser engine had, up to November, 1900, obtained orders for 21 engines, aggregating 16,300-horse power. It is therefore clear that we are on the eve of an immense development of the large gas-engine as an agent for the generation of cheap power from furnace gases and gaseous fuels of similar composition. Unfortunately, this country seems, somewhat unaccountably, to have so far neglected this means of utilizing the waste energy of its blast-furnaces.

Gas and Water Works Directories and Statistics.—We have received from Messrs. Hazell, Watson, and Viney, Limited, the above-named works for the year 1901-2. Each Directory has reached its twenty-fifth issue; and therefore the volumes now published embody the results of the persistent endeavours on the part of the Editor to improve their contents by adding to the information furnished. The title-page sets forth that the statistics and other particulars have been corrected up to August last, and inserted in the volumes are supplementary lists of places of which details reached the Publishers too late for classification. Preceding the statistics are the names of the Chairmen, Managers, Engineers, and Secretaries; together with lists of the Gas and Water Associations. The volumes are bound in the usual style.

WATER ACTS FOR 1901.

(*Continued from p.* 1157.)

The Barrow-in-Furness Corporation Act contains a part relating to water. It authorizes the construction of a Seathwaite Tarn Reservoir and a weir across the River Duddon. The Corporation may take 2 million gallons of water daily from the River Duddon so long as its flow is at the rate of 5 million gallons per day or more. If the flow of the stream amounts to 15 million gallons per day, the Corporation may take their maximum of 3 million gallons per day. Not less than 3 million gallons per day is to pass down the stream. Fish passes are to be made in connection with the Duddon weir, also paying £120 to the Trustees of the river fishery. The rights of the Rural District Councils of Ulverston and Bootle are reserved. The authorized works are to be completed within ten years. An additional water-works loan of £175,000 is sanctioned, to be repaid in fifty years. A water reserve fund of £25,000 may be formed.

The Blackburn Corporation Act contains a few miscellaneous clauses relating to water supply. Power is taken to supply water for filling any trade reservoir ordered by the Corporation to be emptied and cleaned for sanitary reasons. Owners of houses are required to provide them with a proper and sufficient water supply, under a penalty of £5 and 40s. per day. The area of the borough is extended for all purposes.

The Bradford Corporation Act empowers the Corporation to make a new road at Pateley Bridge in connection with the water-works undertaking, and to borrow £22,000 in respect thereof.

The Derby Corporation Act contains a part relating to water-works. It authorizes the construction of four filter-tunnels in the parish of Allestree, with tank, to be completed in five years. The sum of £50,962 is to be borrowed for water-works purposes.

The Derwent Valley Water Act confers further powers on the Derwent Valley Water Board. Certain works authorized by the Act of 1899 are to be abandoned, including the Derwent Reservoir, subject to the liability to compensate all persons for any damage due to such abandonment. Additional lands are to be acquired within five years, and a new substituted Derwent Reservoir is to be constructed, partly in the parish of Hope Woodlands and partly in the parish of Derwent, with the necessary subsidiary works. The Board are empowered to borrow £400,000 for the construction of the works and the purchase of land. The money may be raised by the issue of bills of not less than three nor more than twelve months' date, and not of less amount than £1000, nor be payable to bearer. The Board and the Corporation of Sheffield may agree upon arrangements for the prevention of plumbism. The Board are empowered to take parliamentary proceedings on their own initiative.

The Harrogate Water Act authorizes the Corporation to construct additional water-works, including a reservoir to be called the Roundhill Reservoir on a tributary of the River Burn known as Pott Beck. During the construction of the works the water of the local streams may be used for motive power. The necessary lands are to be compulsorily acquired during the next five years, and the works are to be completed within ten years. Compensation water is to be discharged from the reservoir at the rate of 1,345,000 gallons per day; and the reservoir is not to be filled

when the flow of the Pott Beck is less than this quantity. The Leeds Corporation are protected by special clauses referring to their own powers on the same watershed. The Ripon Corporation can demand to be supplied with 200,000 gallons of water a day, at the price of 4d. per 1000 gallons unfiltered. The Ripon Rural District Council have a right to a supply for certain parishes at 6d. per 1000 gallons. Knaresborough, Pately Bridge, and other localities have similar rights. The sum of £325,000 is to be borrowed for the purposes of the Act, repayable in sixty years.

The Heywood and Middleton Water Board Act empowers the Board to acquire lands within five years, and to construct additional water-works, comprising an extension on the south-west side of the "Reservoir No. 1" authorized by the Act of 1877, the whole to be called the Ashworth Moor Enlarged Reservoir. Compensation water is to be discharged into the Cheesden Brook at the rate of 530,000 gallons during ten consecutive hours of all working days throughout the year. The enlarged reservoir is only to be filled with the surplus water of the same brook over 300,000 gallons per day. The Manchester Ship Canal Company are interested in this compensation water. The authorized works are to be completed within ten years. The water limits of the Board are defined. The Board are authorized to borrow the sum of £110,000 for the purchase of lands and the execution of the works mentioned in the Act, and £65,000 for other water-works purposes. A schedule contains the portions of the old Heywood Water Acts saved from repeal.

The Kettering Urban District Water Act empowers the Urban District Council to construct additional water-works, comprising a reservoir, to be called the Orton Reservoir, in the Valley of the Slade, and in the parishes of Rothwell and Orton, Northamptonshire. A second reservoir, called the Malsor Reservoir, in the same locality, is also sanctioned, All the works are to be completed within ten years. The waters of the Slade and Thorpe streams are to be taken, subject to the discharge of a quantity of compensation water to be determined by a Referee upon data specified. Certain millowners are specially protected. The Act contains numerous provisions relating to affected interests. The sum of £126,500 is to be borrowed for the purchase of lands and the construction of the authorized works, and £10,000 for other water-works purposes.

The Kingston-upon-Hull Corporation Act contains a part relating to water. It enables the Corporation to hold lands in the township of Cottingham for the prevention of the fouling of their water supply, and to make bye-laws for the same object. The sum of £37,000 is to be borrowed for this purpose, repayable in 60 years. The Corporation may raise money by issuing bills.

The Leeds Corporation Water Act authorizes the construction of a reservoir, to be called the Colsterdale Reservoir, upon the River Burn, another reservoir upon the Pott Beck, and two more to be called the Carlesmoor and Laverton Reservoirs respectively. Compensation water is to be discharged according to a prescribed scale. The works are to be completed within ten years. The Harrogate Corporation, and the Rural District Councils of Ripon, Knaresborough, and Pateley Bridge are protected, as also are several landowners. The sum of £2,200,000 is to be borrowed for the purposes of the Act.

The Mansfield Corporation Act contains a part relating to water. It empowers the Corporation to maintain and carry on their water undertaking; and repeals parts of the Act of 1870. The sum of £20,000 is required for water-works purposes.

The Rhyl Improvement Act contains a part relating to water. It defines the limits of supply, and authorizes the construction of new works, including a reservoir, to be called the Dolwen Reservoir, in the parish of Llanyfydd, Denbighshire, for impounding the waters of the stream of this name. The works are to be completed within seven years. Water for farm purposes may be supplied by meter. The sum of £18,000 is to be borrowed for water-works purposes.

The Ripon Corporation Act authorizes the Corporation to construct additional water-works, consisting of a new pipe-line from Grantley to the service reservoir of the Corporation. The water supplied by the Corporation is to be treated for the prevention of plumbism. The work is to be completed within ten years. The Corporation are empowered to enter into agreements with other authorities for the supply of water in bulk. The sum of £20,000 is to be borrowed for water-works purposes.

The Rugby Water and Improvement Act contains a part relating to water, which enables the District Council to lay down a line of pipes from Brownsover Mill pond to the Avon pumping-station of the Council. The work is to be completed within five years. An agreement of the Council with the owners of Rugby Mill, relating to the payment of compensation in respect of water taken from the River Avon, is cited and explained. The sum of £45,500 is to be borrowed for these extensions, and £1600 to repay the Council the money expended by them in laying water-mains in the parish of Bilton.

The Salford Corporation Act enables the Corporation to obtain from the Corporation of Manchester a further supply of water in bulk for the township. The additional quantity is to be obtainable at three months' notice, under stated conditions, at a price to be determined, if necessary, by arbitration. Not more than £50,000 is to be borrowed for the purposes of the Act.

The Sheffield Corporation Act contains a clause extending to the close of 1925 the period fixed by the Act of 1893 for the completion of the Broomhead and More Hall Reservoirs and of the Wadsley Service Reservoir.

The Stockport Corporation Water Act authorizes the construction of additional water-works, including a storage reservoir upon the River Kinder in the parish of Hayfield, Derbyshire, and numerous other works, estimated to cost £756,000. The land is to be compulsorily acquired within seven years, and the works completed within ten years. Referees are to be appointed to determine the amount of the rainfall in the watersheds of the Rivers Kinder and Sett, in order to settle the amount of compensation water. The water supplied by the Corporation is to be treated for the prevention of plumbism. The New Mills and Hayfield Urban District Council have a right to a supply of water on specified terms. Various interests are protected. The sum of £64,000 is to be raised for the purchase of land.

The Sutton-in-Ashfield Urban District (Water) Act empowers the Council to borrow £5000 for water-works purposes, repayable in 25 years.

The Tees Valley Water Act enables the Board to supply surplus water in bulk to the owners of the Redcar and Coatham Iron-Works, to the amount of 2 million gallons per week. Another clause deals with the accounts and audits of the Board.

The Winsford Urban District (Gas Transfer, &c.) Act contains a clause to equalize the periods allowed for the repayment of water loans authorized by previous Acts.

OBITUARY.

We regret to learn, through "Het Gas," of the death on the 23rd ult., of Heer J. DE BATS, the Manager of the Gas and Water Works at Schiedam, in Holland. He was 35 years of age, and had only occupied his post since February, 1899, having previously been Gas Manager at Harlingen, after a course of training at the Hague Gas-Works, and at Messrs. Klönne's, at Dortmund.

Mr. A. H. SMEE, M.R.C.S. (Eng.), Director and Chief Medical Officer of the Gresham Life Assurance Society, died on Friday at the Grange, Hackbridge, Surrey. Mr. Smee contributed many articles to the medical and daily papers, as well as to the "JOURNAL," on the purity of water supplies and the prevention of epidemic diseases. Only a few days ago, he published a book dealing with comparative rates of mortality.

Within a few days of completing his 94th year, there passed away, at his residence at Caerleon, on Monday last week, Mr. JOHN LAWRENCE, who was one of the promoters of the Newport Water-Works Company about 55 years ago. The undertaking was acquired by the Corporation in 1888; and one of the schemes handed over to them was that for the construction of the reservoir at Wentwood, which they are now carrying out.

An error was made in our "Obituary" column on the 29th ult., when mentioning the death of Mr. Alderman Townsend. It was there stated that he had for many years been Chairman of the Reading Gas Company; whereas the town named should have been Abingdon. The present Chairman of the Reading Company (Mr. J. Okey Taylor) is in good health; and though he is advanced in age, we trust he may for many years be spared to occupy the position he holds.

NOTES.

Gas-Engines in Flour-Mills.

Gas-engines, especially those driven with producer gas, find useful employment in mills in Germany. According to "Die Mühle," the percentage of heat converted into power by different engines is as follows :—

	10 H.P.	25 H.P.	50 H.P.	100 H.P.
Steam	4·9	5·6	8·7	12·0
Illuminating gas	25·2	28·4	31·5	31·5
Producer gas	22·0	24·2	28·5	28·5

The cost of fitting up the plant is estimated as follows: Steam, £2120; illuminating gas, £1248; producer gas, £1760. The cost per horse-power-hour for fuel, with a 100-horse engine, running 7200 hours per annum, is calculated as follows: Steam, 0·26d.; illuminating gas, 0·6d.; producer gas, 0·14d. Wages, wear and tear, and lubrication only come to a trifling amount; and, on the whole, the estimates are in favour of the motor worked by producer gas. It should be stated, however, that the figures here given were obtained from an Italian source.

Character of Texas Petroleum.

In connection with the speculation that has arisen in Texas petroleum, it is stated in the "Petroleum Review" that Dr. Dvorkovitz has visited the spot. He reports that the Texan deposit is undoubtedly very prolific, but that the oil has certain serious drawbacks, which must be recognized. The chief of these is that the oil itself contains 2 per cent. of sulphur, and only a small percentage of kerosene, which therefore reduces it to the grade of a fuel or gas oil. Even for these uses it is necessary to remove the sulphur, which Dr. Dvorkovitz considers not a difficult operation. In fact, there are already two processes, either in use or in preparation, for desulphurizing the oil on the spot, which is asserted to cost not more than 1s. 6d. to 2s. per ton. The lack of kerosene is stated to be compensated for by the possibility of making a large proportion of "Solar" oil, such as is now chiefly obtained from Russia. In the opinion of Dr. Dvorkovitz, Texan

Solar oil will in the future displace the Russian product in the United Kingdom for gas making. Thus it is either for exportation to Europe for gas manufacturing purposes, or as fuel oil for the Southern States of America, that this new product will prove profitable, if at all. Meanwhile, there is no means of getting the oil over seas in quantity, owing to the lack of tank-steamers; and it therefore possesses only a nominal value locally—from 1 to 1½ cents per barrel being the prices named in reports. The subject has also been reported upon from the University of Texas by Dr. W. B. Phillips. Mr. W. L. Prather, President of the University, has kindly supplied us with a copy of this report. It is stated here that the crude oil is very sulphurous, and only yields from 5 to 10 per cent. of kerosene. Its yield of very heavy burning oil, similar in specific gravity to Russian Solar oil, is also small. The Texan product has a very offensive odour, which must prevent its use as an illuminant.

Treatment of Boiler-Feed Waters.

According to a report by Mr. C. E. Stromeyer, the Chief Engineer of the Manchester Steam Users' Association, presented at the last annual meeting of the Association, a chemical laboratory has been established and worked under his supervision for a year, with the result that full information has been obtained as to the scale-forming and corrosive constituents of most public water supplies in the United Kingdom. Members of the Association using these waters are receiving revised instructions as to treatment. To the very general request of how scale can be got rid of entirely, the only possible reply is that the water should be treated before being put into the boiler. This led to inquiries as to the best feed-water purifiers and the cost of working them, which has been inquired into, with the following result: The Chemist of the Association made a tour of investigation, in the course of which he inspected the working of fifteen water-softeners. He formed the conclusion that the intermittent Archbutt-Deeley system, and several of the more refined continuous water-softeners which he saw in action, should give excellent returns, provided that they are properly worked. This is not always the case, owing to inadequate supervision and the imperfect instruction of the attendant. It is essential that rough chemical tests should be occasionally made to ascertain the hardness of the water before and after treatment. There is nothing alarming or deterrent about this requirement, which can be carried out by anybody with the aid of standard soap and acid solutions, which can be bought, and the quantities of lime and caustic soda to be used thus determined. Roughly speaking, the cost of the plant per 1000 gallons treated per hour will be from £100 to £150; and as 750 gallons per hour is about as much as one 8-feet Lancashire boiler can evaporate, it comes cheaper to lay down such a plant than to have a spare boiler. The chief saving appears to be in the cost of scaling.

Mr. John Marsland has decided to resign the position of Manager of the Sowerby Bridge Gas-Works, which he has held for about twenty-one years.

A memorial to the late Sir Joseph William Bazalgette, C.B., who, as Engineer to the Metropolitan Board of Works, carried out the main drainage scheme for London and designed the Thames Embankment, was unveiled on the Victoria Embankment last Wednesday afternoon, by Mr. A. M. Torrance, Chairman of the London County Council, in the presence of Lady Bazalgette and other members of the family, and of many friends and admirers.

Among the honours noted in the "Gazette" as conferred by His Majesty the King on the occasion of the sixtieth anniversary of his birthday last Saturday, we notice knighthoods for Mr. Francis J. S. Hopwood, C.B., C.M.G., Permanent Secretary to the Board of Trade, and Mr. J. Ernest Spencer, who has represented West Bromwich in the Conservative interest since 1886. The new K.C.B., it may be remembered, was Assistant-Secretary in the Railway Department of the Board of Trade, and a few months ago succeeded the late Sir Courtenay Boyle as Permanent Secretary. The new knight, as is well known, has been connected all his life with the borough he represents. His father owned the Phœnix Iron-Works; and he himself was until recently a member of the firm of Messrs. J. E. & S. Spencer. He left the tube business to devote himself to the study of the law, and he was in due course called to the Bar and went the Oxford Circuit.

In the list of Mayors for the new municipal year, we notice the names of the following gentlemen who are more or less closely connected with gas and water supply: Sir John Aird, Bart., M.P., Paddington, is Chairman of the Cagliari Gas Company, and a Director of the Gaslight and Coke Company; Mr. E. Boulnois, M.P., Marylebone, is Chairman of the West Middlesex Water Company and of the Staines Reservoirs Joint Committee; Alderman Bartlett, Arundel (fourth time), is Chairman of the Arundel Gas Company; Mr. J. Battersby, Bury (Lancs.), is a Director of the Radcliffe and Pilkington Gas Company; Mr. J. A. Bellamy, Plymouth, is the Chairman of the Plymouth and Stonehouse Gas Company; Sir Henry Harben, Hampstead, is upon the Board of the New River Company; Mr. J. H. Lloyd, Birmingham, is Chairman of the Gas Committee of the Corporation, and of Lloyd and Lloyd, Limited, Albion Tube-Works, Birmingham; Alderman Miles, Bolton, is well known, personally and by repute, to a great many of our readers; and Mr. F. Rendall, Devizes, is Chairman of the Gas and Water Committee of the Corporation.

COMMUNICATED ARTICLES.

THE PRODUCTION OF ILLUMINATING GAS FROM COKE-OVENS.

Dr. F. Schniewind's Reply to the Glasgow Gas Congress Discussion on his Paper.

Under date "New York, Oct. 25," Dr. F. Schniewind writes: "I enclose an answer to the various questions which were raised in the discussion on my paper, on the 'Production of Illuminating Gas from Coke-Ovens,' read before the Gas Section of the International Engineering Congress at Glasgow—see 'JOURNALS' for Sept. 17, pp. 691-706."

I wish first of all to express my appreciation for the kind comments made upon the paper. It would have afforded me pleasure to have answered the various questions personally; but it was impossible for me to be present at the Congress. Consequently, I take these means to give the additional information desired.

Preparation of Coal.

It is preferable to use small coal for the charging of the coke-ovens. If "run-of-mine" coal is used, it is generally broken before charging it into the oven. A set of rollers perform this work at an insignificant expense. The coke becomes denser when fine coal is used; and the distribution of the slate and impurities is more uniform. The coke is generally broken fine enough to pass through a 1½-inch screen.

The coal is washed only in case it is high in impurities, and in case the requirements for the coke make this washing necessary. If the coke is to be used for domestic purposes and under boilers, then in the United States washing would not be considered necessary, unless the proportion of ash in the coal is going above 10 per cent., and that of sulphur above 1½ per cent. If coke for metallurgical use is to be manufactured, then the American requirements are that the ash in the coke should not exceed 10 to 11 per cent., and the sulphur 1 to 1¼ per cent. There are generally coals available which allow the manufacture of a metallurgical coke within these limits without resorting to a washing of the coal.

Preparation of Coke.

The coke when used on locomotives and under stationary boilers is not prepared; but "run-of-oven" coke is used for these purposes. For use in house furnaces, the coke is broken, and egg-size is employed. For kitchen ranges, a smaller coke (nut size) is commonly used. The fine coke (breeze) is either mixed with the coal and charged back into the ovens, is used under boilers, or is sold to steel and cement works.

Gas Yield.

The coke-oven obtains less total gas per ton of coal than the gas-retort, if the same coal is used in both. This is explained by the difference of temperature of the coal charge in both carbonizing processes. The difference in yield depends greatly on the difference of temperature; and under ordinary conditions we may assume that the coke-oven produces about 800 cubic feet less per ton of coal than the gas-retort. This gain in the volume of gas is, however, off-set to a great extent by the destruction of tar and ammonia in the hotter gas-retorts, and by a reduction of the calorific value of the gas.

In the coke-ovens, it is a desire to keep the top of the ovens, along which the gases travel, as cool as possible; while in the gas-benches, the top of the retorts is just as highly heated as the bottom, which results in the above-mentioned destruction of bye-products. The travel of the gas in the retort coke-ovens is from the carbonizing zone in a horizontal direction, through the coke already formed, to the side wall of the ovens. Between this side wall and the hot mass of coke, a small space forms early in the carbonizing process—due to the usual contraction in volume when converting coal into coke. Then the gas passes vertically through this space, between the coke and the wall, to the top of the coal charge; and from there horizontally, between the coal charge and the roof of the retort, to the gas-escape pipe.

Heating of Coke-Ovens by Gas.

It appeared strange to some of the speakers in the discussion that a system is advocated in which the retorts are heated by a part of the gas. Mr. Stephenson stated (see "JOURNAL," Sept. 17, p. 704) that "their purpose was more the manufacture of gas than residuals." I should rather be inclined to modify this statement as follows: "The purpose of the gas engineer is to manufacture gas of the best possible quality in the most economical way." With this object in view, I must insist that the coke-oven process in many localities is by far the preferable. An example will possibly make clearer why it is not unreasonable to heat the coke-ovens with gas instead of coal. The "Iron and Coal Trades Review" for Oct. 4 last, gives the price of furnace coke at Middlesbrough at 16s. 6d. For carbonizing 100 tons (gross) of coal in ordinary gas-retorts would require about 15 tons of coke. This coke, when produced in coke-ovens, would be at least equal in quality to the best furnace coke in the English market. The

15 tons of coke would, therefore, be worth £12 7s. 6d. In the coke-ovens, the carbonization of the 100 tons of coal would require about 600,000 cubic feet of gas, which would then have a fuel value of £12 7s. 6d., or 5d. per 1000 feet. In other words, if the coke-oven process should produce the gas at a cost in the holder of less than 5d. per 1000 feet, then it is preferable to heat the coke-ovens by gas. As a matter of fact, the coke-ovens, when manufacturing metallurgical coke under present market conditions for coal and coke, will produce the gas for nothing, or it will even stand to a credit in the holder. Consequently, there cannot be any question that the heating of the coke-ovens by gas is the more economical process. This is borne out by the fact that—especially in England—the gas and bye-products obtained in the manufacture of metallurgical coke are at present thrown away; and yet the manufacture of coke is a profitable one.

The conditions are not quite the same in the case of the manufacture of coke for domestic purposes. As is shown in the first part of my paper, a great many American cities pay a premium for smokeless fuel; and I have no doubt that English cities would do the same thing—viz., that they would pay more for a ton of smokeless coke of proper quality than for a ton of smoking, bituminous coal. If then, per ton of coke, a price could be realized sufficient to cover the cost of the coal (1¾ tons), the bye-products (tar and ammonia) will more than cover the carbonizing and purifying expenses, also interest on capital invested; and the gas will cost nothing in the holder. I am of the firm belief that the large English cities will readily pay such a price for properly prepared smokeless fuel in order to get rid of the terrible smoke nuisance. The results obtained at Boston and elsewhere in the United States surely warrant such an opinion.

Auxiliary Producers.

The above statements will explain why in most cases it is not profitable to heat the ovens by producer gas, which, on the other hand, from a technical point of view, is perfectly feasible. On the one hand, a gas which costs nothing is available; while, on the other hand, coke, which can be sold at a certain figure in the market, must be used. However, in many cases the coke-oven plant may be of such capacity that, with its ordinary surplus gas, it will meet the requirements of the minimum summer day, and then the increased demand during the winter has to be made up by some auxiliary gas plant. For this, as explained in the paper, either a water-gas or producer-gas plant can be used. The water gas could be mixed with the coke-oven gas or the producer gas could be burned under the ovens, in which manner more coke-oven gas would be realized.

Mr. Charles Hunt desired additional information on the producer-gas plant now in use at Boston. We have in operation there three producers of the Taylor type, in which the coke is gasified. This coke is the refuse which is gathered up in the yard, and would have to be sold at a lower price on account of its poor appearance. The producer gas is scrubbed, in order to free it of dust; and it is then mixed with the poor coke-oven gas and burned under the ovens. Each of the producers has a capacity of 6 tons of coke per day; and, per ton of coke, we reclaim 42,242 cubic feet additional coke-oven gas, according to a set of careful determinations by Mr. C. S. Lomax, the Chief Chemist of the New England Gas and Coke Company. The calorific value of the coke is 13,280 B.H.U. per pound, and the heat equivalent of one net ton of coke is 26,560,000 B.H.U.; the 42,242 cubic feet of gas have an average fuel value of 600 B.H.U.; and the total value of the gas recovered is 25,345,200 B.H.U.

The efficiency of the producer plant is consequently 95·4 per cent. This is an extraordinarily high efficiency; but it may find its explanation in improved combustion conditions, due to the admixture of producer gas to the poorer part of the coke-oven gas.

During the efficiency tests, the average daily surplus gas production was 6,867,000 cubic feet of 18·66-candle power. When the producers were shut off, the surplus gas was reduced to 6,251,700 cubic feet of 19·35-candle power. The amount of coke used was, on an average, 14·566 net tons per day.

The conditions of each locality will have to decide whether it is more advantageous to design the coke-plant for the maximum daily requirements in the winter time, and then reduce the capacity of the plant during the summer (or eventually waste some gas during the summer), or to design the plant for the minimum capacity in the summer time, and operate it to its full capacity all the year round—depending in this case upon the auxiliary water gas and producer plant to make up for the increased winter demand.

Combustion Chambers.

Mr. W. R. Herring put a question in regard to the combustion chambers underneath the ovens. We have found it more advantageous to make the combustion as complete as possible in a separate chamber, and then let the products of combustion pass through the heated flues between the retorts. This is more advantageous than burning the gas directly in the flues between the retorts; for the reason that local over-heating by a flame cannot be avoided, and then the liability of cracking becomes greater when the retort is suddenly cooled by the cold coal charge. The coke-oven does not require such high heats as are usually employed in the gas-benches, which is a great advantage in regard to the maintenance of the brickwork. The life of a gas-retort seldom exceeds 800 to 1000 days; the coke-ovens last from eight to twelve years without great repairs.

Names of Companies.

Mr. James Barrow stated that the Everett Coke-Works are named after Mr. Everett. This is not correct. The name of the Company is "The New England Gas and Coke Company;" and their works are located at Everett (near Boston), Mass. Another plant is in operation at Sydney, Cape Breton, Nova Scotia, which plant is owned by the Dominion Iron and Steel Company. Mr. Henry M. Whitney is the President of both of these Companies. Both plants were erected by the United Coke and Gas Company, 277, Broadway, of which Mr. W. L. Elkins, jun., is President.

Cost of Plant.

Mr. W. W. Hutchinson inquired in regard to the cost of the plant. An average figure can hardly be given, because it depends to a very great extent on the cost of materials of construction. We may figure the cost as £600 to £1200 per oven, of a daily carbonizing capacity of 8 (net) tons of coal. This includes complete coal and coke handling plants, condensing and bye-products apparatus, &c. Generally speaking, it may be assumed that, per ton of coal carbonized, a coke-plant costs one-third to one-half of an ordinary coal-gas works. The gas output per ton of coal carbonized is, however, only 4000 cubic feet in the case of the coke-oven plant, as compared with 10,000 cubic feet in the case of the gas-retorts. Thus, if there is any difference per 1000 cubic feet of gas sold, it is rather in favour of the coke-plant.

Enriching of Gas.

Mr. Charles Hunt stated, during the discussion, that "the author lays stress upon the desirability of separating the gas into rich and poor gas. Well, they had already got beyond that in this country. They were not going to separate gas; they were not going to enrich any more than they could help in the future." It seems that Mr. Hunt wants to make necessity a virtue. The facts are that, with the introduction of the incandescent burner, the candle power of the gas has become of less importance, and consequently the gas-works have justly increased the gas output per ton of coal at the expense of the candle power. This has enabled them to reduce the cost of the gas. To increase the candle-power of the coal gas made under the high retort temperature to a candle power which is customary in the United States, on account of the widespread adoption of water gas, would be connected with great expense. In the case of the coke-ovens, it is different. A gas of a very high candle power is produced without any enriching whatever. The fact that the gas has such a high candle power should not be considered as an objection. If, however, the high candle power is not wanted, it would be easy to scrub out the benzol vapours, which would still further increase the revenue of the process.

Cost of Residuals.

The objection has been raised that the introduction of the coke-ovens would greatly reduce the value of residuals. I cannot go into this matter quite fully at this point, but expect to treat the question in some future paper more exhaustively. I may state, however, that judicious propaganda among the farmers would greatly increase the ammonia market. Concerted action on the part of the ammonia producers in regard to the disposal of the product, would undoubtedly react beneficially on the price of sulphate. In England, there could also be opened a very large outlet for tar products, if roofing paper were manufactured on a more extensive scale. The roofing-paper industry consumes the bulk of the American tar.

Early Experiments in Utilizing Coke-Oven Gas.

Mr. Charles Hunt stated that he had called attention to the coke-ovens at the 1896 meeting of the Institution of Gas Engineers. I find his paper in the "JOURNAL," Vol. LXVII., p. 1090. The paper gives an investigation of the gas from the Semet-Solvay coke-ovens at Brymbo. Mr. Hunt stated, however, as follows: "In what light, then, ought the system to be regarded? Ought it to be approached as a possible ally, keeping in view its advantages in the saving of labour? or must its advance be watched at a distance, as those of, to all outward appearance, an intractable competitor? To the believer in moderately thin charges as a means of economical carbonization—and who among gas makers is not?—this method of carbonization by charges 4 and 5 feet thick, and weighing from 4 to upwards of 6 tons, can present but little attraction."

On the other hand, the writer has published in the "Iron Age," of March 21, 1895, an article on coke-oven gas, with special reference to American conditions, in which he came to the following conclusions.

(1) The Otto-Hoffmann coke-oven gas is cheaper than all others, because it is a waste product, and can easily be saved.

(2) It has a higher calorific value than either the water or producer gas.

(3) It can be converted into an excellent illuminating gas by removing the carbonic acid, sulphuretted hydrogen, and naphthalene, and enriching it to increase the candle-power.

(4) A large and regular supply of this gas can be obtained. In case of sudden increased demand, all the gas produced by coking the coal could be turned into the pipe by making water or producer gas from the coke in the generator held in reserve for that purpose. The coke could be dumped into the same in the hot state, as it comes from the coke-ovens, and so no time is lost in producing the water gas.

(5) The pipe system used at present for the transportation and distribution of natural gas will carry to the consumer the same

amount of heat by Otto-Hoffmann coke-oven gas as by natural gas, without increasing the gas pressure.

The common belief is that the gas manufacturer's sole purpose should be the making of gas. This is a narrow view, as the demand for energy in various forms by large cities is very much greater than that supplied at present in the form of gas. The chief source of light, heat, and power is bituminous coal. This is at present supplied in an objectionable form—resulting in the "smoke nuisance." The gas-works seem to be destined to solve this problem, if they will emancipate and become "coal-carbonizing plants," instead of simply "gas-works." If only a small part of the coal in the large cities should pass through a carbonizing plant, then all the gas requirements of the city could be readily filled; and at the same time a better and cheaper gas could be supplied. Gas will, and must, become a "bye-product," and the sooner the gas engineers realize this, the better their interests, and those of the public, will be served.

AUDITING GAS-WORKS ACCOUNTS.

By A SHAREHOLDER.

(*Concluded from p.* 1092.)

The subject of repairs, maintenance, and renewals in some sense presents special difficulties, as affording room for considerable differences of opinion. Certain items may be allocated to revenue or to capital, according to the views of the parties responsible for the expenditure; and the evident sense of the Act is that matters of this kind should be dealt with by the directorate and staff—the auditor being at liberty to present his views in the form of a report upon the accounts. The proper person to undertake the duty of making these allocations between capital and revenue is the engineer responsible for carrying out the work, who is the only official possessed of sufficient acquaintance with the whole of the details to be in a position to form a reliable and accurate opinion. Items coming under the head of repairs and renewals to retorts, works, purifying apparatus, gasholders, mains, services, and meters, form a very important proportion of the total annual expenditure—sometimes exceeding the amount available for dividend; and they are frequently mixed up very intimately with extensions and additions. Occasionally, certain items can be let by contract for an inclusive sum, or purchased as to be delivered in position ready for use. But a very large proportion of the work is executed by the Company's own staff of workmen, and with materials that have first been taken into store or stock. Retorts, fire-bricks, iron pipe, meters, and many other things do not admit of being bought in separate parcels for each job.

Usually a supply for the year is purchased at an agreed price; the goods being charged to a stock account as purchased, and debited to various items, including both revenue and capital, as they are used. Take, for an illustration, such operations as the replacement of beds of sixes by beds of eights, the substituting of regenerator for grate furnaces, or sloping retorts in the place of horizontals, of extending the foul mains, enlarging the purifiers and connections, or the renewal (and at the same time enlargement) of mains and services—all of which present examples of the application of the same descriptions of material and labour to purposes that are partly renewals and partly extensions. Any retort setter, main layer, fitter, or labourer may be engaged one day on a renewal and the next on an extension. The retort work executed during the season may comprise eighteen beds, of which six are simple renewals on the old lines, six are replacements including modern and more costly arrangements while utilizing a part of the old material, and the remainder are *bonâ fide* new and additional settings rendered necessary by the growth of the business. The consumption of iron piping may amount to 5000 feet run, including renewals, extensions, and sales. How is it possible for an auditor to come along in six months' time and decide, from inspection of the books and vouchers and a cursory and untechnical look round the works, how much or what proportion should be charged to capital, or to criticize and, if thought desirable, correct any allocation that has been made. Before he can be in a position to deal adequately with considerations of this sort, the auditor must have every pipe and every brick bared, measure up and calculate out full bills of quantities, and then probably have to fall back on the opinion of an expert in regard to several technical points. Even when the facts are agreed upon, differences of opinion may arise. The proper time to allocate between capital and revenue is as the work proceeds; and in important works the permanent engineer can be assisted, if thought necessary, by an architect, clerk of works, or other temporary official.

Then there are matters involving questions of depreciation, which to the average auditor mean simply the application of some fixed rule, such as 5 per cent. allowance on apparatus and 2 per cent. on buildings. I know one auditor who held that $2\frac{1}{2}$ per cent. for depreciation should form a first charge on the balance of net revenue. But in actual practice, nine out of every ten gas undertakings are run without any considerations of this sort. A very large proportion of the gas-works apparatus and plant admits of piecemeal renewal year by year without any special strain upon the resources of the revenue account. It can readily be proved upon theoretical grounds that this is impossible. All are familiar with the good old "chestnut" about the renewal of a gasholder. Such a case, however, rarely occurs in actual practice; and many who have grown grey in the profession have never suffered from an embarrassment of the kind. One way of meeting any extraordinary renewals is by means of a suspense account. But this simply amounts to a loan on the future of the concern; and the future will probably have enough to do to take care of itself without being burdened with expenses that should have been met in the past. The majority of gas undertakings can, however, be run without depreciation and without suspense accounts. Big events cast their shadows before; and the careful gas manager has his renewals in view some year or two ahead, and is able to keep up the full structural value of his plant without putting an undue tax upon the revenue of any one particular year. The need or otherwise for a depreciation fund is a debatable question to be decided upon the merits and the circumstances of each case.

Another question in this connection is whether the plant or property should remain on the books at the original cost, or at the current replacement value. The probability is that a piece of apparatus—comprised chiefly of cast iron, and put down some fifty years ago—could now be replaced, or duplicated, at half the original cost; or the march of improvement may now admit of a simpler and less costly design. On the other hand, some kinds of property may appreciate in value. A plot of land purchased fifty years ago may to-day be worth ten times the original cost. A common maxim is that the difference in cost only as between the new and the discarded plant is chargeable to capital. But the plain application of such a rule, without some knowledge of the surrounding circumstances, may result in the current year's expenditure being charged with an unwieldy sum—sufficient to give an entirely false idea as to the position of the affairs—or it may be abnormally swollen by an unexpected windfall. A large increase in the profits is readily dealt with and put in its correct position; but a deficit is not such a simple matter, and always creates a certain amount of suspicion and distrust. Many other examples might be quoted of financial questions that cannot be dealt with more adequately than at present by any improved system of auditing, but must be adjusted either by the staff or the directorate once for all as they arise, with the aid of a full and accurate knowledge of the whole details beyond that which an auditor could reasonably be expected to possess.

It can also be shown that the greater portion of the annual expenditure can only be dealt with in a partial way by the auditor as a matter of account, and that when once the directors have been satisfied that an account is payable, no further advantage can follow upon a second elaborate investigation and checking up of the same. If anything more searching is required, it would be necessary to give the auditor a permanent location, and to establish an auditing department comprising a staff of experts and assistants, of an extent proportioned to the magnitude of the undertaking, who would follow up each operation day by day, measuring up materials and checking labour, &c. This would simply come down to the costly and unsatisfactory operation of playing policeman, hampering the operations of the concern, and following responsible officials from pillar to post in the objectionable manner already indicated.

With regard to the disposal of the balance of net revenue, the payment of interest on loans, the increase of capital from time to time, and other matters of a financial character, the professional auditor is quite in his element, and able to render valuable assistance. It is at this point that his services are required, rather than in connection with technical matters relating to the everyday working. The probability is he will be able to bring to bear a wider experience in regard to other similar undertakings than is possessed by the average director or manager.

The object of these remarks is to bring out the point that a mere extension of the audit, even up to a full legal investigation of each and every transaction undertaken by the concern, would not secure an advantage in any way proportionate to the unavoidable increase of expense and hindrance to everyday working. The expense could be applied to much better advantage in improving the staff and methods of working, and in more accurate book-keeping in relation to matters of expenditure. The weak place in many gas-works accounts is the absence of a proper cost clerk. Even where all the personal accounts are carefully and accurately kept, there may be some looseness in the preparation of the nominal accounts, especially in relation to stores. Directors very naturally desire to avoid employing a larger staff than is actually necessary, and from commendable motives of economy do not believe in keeping more cats than appear to be necessary according to the mice to be caught; and they do not always appreciate the extent of the work to be done, or that should be done, in the way of booking up stores, both inwards and outwards. There are numbers of small units that must be purchased in bulk—by the ton, the gross, or the thousand feet run; such as pipes, fittings, incandescent mantles, and accessories. However trifling the individual value, there should be a stock-book, by means of which the disposal of every unit can be traced. Of thousand feet run of wrought-iron pipe purchased, the book should show how much have been used for various purposes, and the balance should exist in the stores. The same as regards incandescent mantles. The book should enable the disposal of every dozen purchased to be traced. "Take care of the pence and the pounds will take care of themselves" applies to many other things besides money. If there is a "leakage" in the stocks, it is more likely to be in regard to small trifles in common demand—such as nails, hooks, burners, mantles, &c.—than in connection

with stoves or meters, which cannot be disposed of without a certain amount of risk. The mere fact of large quantities of small goods laying about uncared for is of itself sufficient to encourage habits of carelessness in the matter of *meum* and *tuum* among the workmen. Many gas-works even of considerable magnitude are run without anything like a systematic stores and cost department. The purchases of wrought-iron pipe and fittings are at once charged to service repairs, compo. pipe to meters or fittings, and so on, without anything to show that the materials are actually used. Tools in common demand, such as shovels, are dealt with in the same free-and-easy way. It would pay well to keep an accurate record of these things; but the manager, or the rental clerk, cannot run this department as a mere stop-gap for odd moments.

It must also be remembered that, in addition to the signature of the auditors, the accounts are certified by the secretary, the manager, or the chairman of the board of directors. The permanent official certifies as to the matters of the nature above indicated that come beyond the scope of an auditor; and no reasonable person could attach more value to the auditor's signature than it purports to carry—viz., that the signatory has examined the books and accounts. This is all that the auditor is at present called upon to do; and as a rule he does it efficiently. There is no truth in sweeping assertions to the effect that his signature is valueless. Whether it is desirable to extend his field of operations so as to embrace an inquiry into every transaction, and the character of every employee, is another question.

Ancient Water-Pipes Brought to Light.—In making excavations recently for some new stabling at Halifax, the workmen employed by the architect unearthed some ancient water-pipes. They were of terra-cotta of fine quality, about 1½ inches internal diameter, and varied in length from 2 feet to 2 ft. 6 in. The ends were hopper shaped; and the joints were formed by a barrel-like insert, also in terra-cotta. No doubt, the pipes were used for conveying water into the town from the Well Head spring, upon which, before the passing of the Halifax Improvement Act of 1853, a good proportion of the centre of the borough was dependent for its water supply.

Gas Journals in Austria.—After an existence of nineteen years as the only representative organ of the gas industry in Austria, our contemporary "Der Gastechniker" has now a promising rival in "Das moderne Beleuchtungswesen," of which the fifteenth part is just to hand. Both papers are published in Vienna, and appear twice each month; but while "Der Gastechniker" is the official organ of the Austrian Association of Gas and Water Engineers, the younger paper depends entirely on popular patronage. It, however, appeals also to electricians, as it covers the whole field of methods of artificial illumination. The last number received contains several articles of interest to gas men.

Gas-Engines in Spain.—The question of establishing manufactories of gas-engines in Spain is one which the "Revista Minera" considers to be worth the attention of capitalists. The opinion is expressed that if a sufficient number of motors to supply the demand are not constructed at home, those obtainable from abroad will be so expensive as to prejudicially affect industry. When the subject of selecting the best type of motor was lately under consideration by experts, the decision come to was in favour of the Oechelhaeuser single-cylinder type, which it is believed will meet general requirements. It is not suggested that a workshop on anything like the lines of the great Westinghouse factory in Manchester should be put up; but if one were established to turn out engines of from 25 to 200 horse power, it would suffice. Spain is the country which produces pig iron at the lowest, and sells it at the highest, rate; and the idea of our Spanish contemporary appears to be that the raw material could be usefully and profitably employed at home.

Additional Water Storage for New York.—In the "Municipal Journal and Engineer" for last month, Mr. W. R. Somers gave a few particulars of the new Croton dam now in course of construction for increasing the storage capacity of the New York Water-Works. In 1872, the city had a population of a million; and the quantity of water required was about 85 million gallons daily. In the two preceding summers the natural flow of the Croton River was as low as 27 million gallons per day. This caused great anxiety; and, as our readers are aware, new reservoirs have been constructed from time to time, till the storage has now been brought up to 44,455 million gallons. The available capacity for impounding water on the Croton River watershed is now being increased by the building of the new Croton dam, which stretches across the valley of the river at a point about 3¼ miles below Croton Lake. It will form a reservoir 19⅜ miles long, and will have a watershed of 373 square miles. The flow-line will be 29 feet higher than the lake, and will increase the available storage from 2000 to 32,000 million gallons; making the total capacity of all the reservoirs of the Croton River watershed about 74,500 million gallons. The largest section of the dam will be 300 feet high from the lowest point of the foundation, which is 134 feet below the bed of the river, and 216 feet thick at the base; the southern end being 220 feet high and 164 feet in thickness. At the top, it will be 18 feet thick. The earthen embankment and core which form the southern end of the dam will be 590 feet long; making the total length of the structure 2300 feet. The dam will cost about a million pounds sterling; and when completed it will be the largest in the world.

TECHNICAL RECORD.

A NIGHT AT THE INSTITUTION OF CIVIL ENGINEERS.

Mr. Charles Hawksley's Inaugural Address.

The heavy cloud of fog which rested over London last Tuesday evening and penetrated every nook and crevice into which it could gain entrance, did not prevent, between 7.30 and 8 o'clock, the continuous roll of conveyances, and the passing of an almost unbroken stream of engineers, into Great George Street to the Institution of Civil Engineers. For the Institution, it was one of the great nights of the year—the night when the new session is inaugurated by the delivery of the presidential address. This is the 83rd session; and its President is Mr. Charles Hawksley, whose patronymic is associated so intimately with the distant past of this wonderful organization. On such an occasion as Tuesday night, some of the early arrivals in the theatre of the Institution could not—while waiting in the presence of the paintings of the distinguished features of the eminent men who have occupied the seat of honour in the engineering profession at various times during the past century—have avoided looking backward and pondering on the marvellous things which have been accomplished by those who have gone before and by some men still living whose names are enrolled in the records of the Institution.

By a quarter to eight, the seats of the theatre were almost filled; by eight o'clock they were so; and shortly afterwards there was a border of members and others of less degree who were compelled to remain standing throughout the delivery of the address. There were engineers present who have been knighted for their magnificent work, others whose work has made them eminent, and numbers whose work brings them rarely into view in the outer world, except in a small way. Young men and youths who are climbing the ladder—some with the desire and aim of reaching the top, and perhaps in the future receiving from their fellows the honours and plaudits bestowed on Mr. Hawksley on Tuesday night. London and the suburbs, of course, contributed by far the largest number; but other parts of the British Isles were also represented. Among the gas engineers who were noticed in the large assembly were Mr. H. E. Jones, Mr. Charles Carpenter, Mr. William King, Mr. J. Tysoe, and Mr. C. E. Brackenbury, and there may have been several others. Of water engineers there were several.

A few minutes to eight, a bell summoned loiterers from other parts of the building; and at eight o'clock sharp, the Council filed in (among them, keen and intent as years ago, being that veteran among engineers Sir Frederick Bramwell), with, in the rear, the retiring President, Mr. James Mansergh, and his successor, Mr. Charles Hawksley. A pause may be made here to mention that this is the first instance in the annals of the Institution in which the presidential chair has been filled by the son of a former President; the late Mr. Thomas Hawksley having twice had the honour conferred upon him—viz., in 1872 and 1873.

The cheers which greeted the heads of the Institution having subsided, Mr. Mansergh, standing by the chair, said it was his duty now to vacate it, and to induct to it their friend Mr. Hawksley. He was well known as the son of an honoured father, who was one of the most astute and learned of their Presidents. Regarding their new President, he (Mr. Mansergh) had had Mr. Charles Hawksley as his professional opponent in another place on many occasions, and in him he had always found, as others had who knew him, a kind-hearted and loyal gentleman of the first water. With these words, which so aptly summed up the character of their subject, Mr. Mansergh vacated the chair, which was then taken by Mr. Hawksley, whose acclamatory welcome by the members was most enthusiastic. Then Sir Frederick Bramwell rose, and in his characteristic pleasant way, spoke, on behalf of members present and absent, of the great services to the Institution of Mr. Mansergh, which, in consequence of the Glasgow Conference, had been unusually arduous. Sir Frederick moved that the thanks of the members be accorded to the retiring President. Once more the theatre rang with the applause of the members, which Mr. Mansergh gracefully acknowledged, remarking upon the distinction which had been his of having occupied one of the most enviable positions that an engineer could have occupied in the first year of the Twentieth Century.

The Address.

These preliminaries duly performed, Mr. Hawksley commenced delivering his address. The composition was a voluminous one. To a large extent it was retrospective; but it also defined the limits to which engineering science has mounted in its many branches. It was a great task which the President set himself; but he did it well. Facts and common-sense pervaded the address; but there was a lack of brilliant phrase to relieve it. This, however, is of small moment when placed in the balance with the solidity and diversity of the subject-matter on the other side. The address was delivered in Mr. Hawksley's usual low tone, but yet with a clearness and purity of pronunciation which carried the words to every part of the theatre.

It does not come within our province to give the whole of the address, nor even to summarize its contents; and so we shall

only extract such portions as fall distinctly within the scope of the "JOURNAL." In dealing with the question of roads, the President availed himself of the opportunity to invite the attention of the large number of municipal engineers and surveyors now connected with the Institution to the great obstruction to traffic now frequently caused by the erection in the centre of the streets of gas or electric light lamp-posts, and standards for carrying the overhead wires of electric tramways. The President next championed the cause of canals; and it appears to him, in these days of a demand for cheap carriage to assist in enabling our manufacturers, traders, and agriculturists to hold their own against foreign competition, to be well worthy of serious consideration whether a combination of all the principal canal undertakings throughout England and Wales, and the carrying out of needful improvement in structures and management, might not again revive the prosperity of those whose interests have suffered from the competition of railways, without injuriously affecting those more fortunate companies who have succeeded in maintaining their position. Such a combination, he thinks, would at the same time promote the public interests by affording an improved and cheap means of conveyance by our waterways—steam or electrical motive power being utilized where possible. It would, however, be necessary to entirely free from control of the railway companies any intermediate canals belonging to them.

Railways and, of course, electric traction and light railways came within the extensive survey of the President. The questions of harbours and docks were discoursed upon; and quite naturally he dropped into a little dissertation on the subject of lighthouses—mentioning in one part that, at the commencement of the century, the only illuminants employed in lighthouses were candles and oil, but now not only have gas and electricity been introduced where the circumstances were favourable for the adoption of these means of illumination, but the burners for oil have been so greatly improved as to enable an intensity of 1800 candles to be obtained from burners having eight wicks and 800 candles from burners with five wicks, the two sizes of oil-burners chiefly employed in the Trinity House service. Ships came in for a considerable treatment; and then wind and water power. From Mr. Hawksley's statements on the last-named subject, we may extract the following little historical note: In the year 1847, Mr. (afterwards Lord) Armstrong, who commenced his professional career as a solicitor, devised his well-known and extensively adopted application of hydraulic power to operate cranes and other machinery. The pressure at first employed was that available from the main pipes of the Newcastle and Gateshead Water Company, of which Company Mr. Armstrong was for a time the Secretary.

The next section of the address we must give practically in full, as it deals with a subject of which Mr. Hawksley is one of our master-hands.

Water Supply.—In his inaugural address last year, my predecessor in this chair, Mr. James Mansergh, gave an interesting account of works constructed for the supply of water to towns during a period extending from about 300 years before to about 250 years after the commencement of the Christian era, and also many valuable statistics in regard to the present supply of water to some of the principal cities in various parts of the world. It may, nevertheless, still be interesting to compare the condition of things in regard to water supply as they existed in Great Britain at the commencement of the Nineteenth Century with their condition at the commencement of the Twentieth Century.

At the beginning of the last century, comparatively few towns had a supply of water distributed by means of pipes, and the inhabitants were mostly dependent on water obtained from shallow and frequently polluted private or public wells, from which the supply had to be drawn or pumped by manual labour. At the present time, there is scarcely a town throughout Great Britain which is not well supplied with excellent water, delivered at the houses of the inhabitants either by a company or by a public authority, and similar advantages are frequently extended even to villages.

As to reservoir dams, I fully concur in the view expressed by Mr. Mansergh, that "we should not allow fashion to run away with us, and so build in stone when earth and puddle would answer the purpose equally well at much less cost," and also in the opinion (which I have previously expressed in this room) that it is essential that a masonry dam "should be founded on an unyielding base of sound rock." But I do not agree with my predecessor in thinking that a depth of 100 feet of water should not be exceeded in the case of an earthen embankment. Neither do I suppose I shall ever have the courage to try the American method of placing a core of concrete in lieu of puddle in the centre of an earthen embankment; for it appears to me to be wrong in principle to attempt to support a practically inelastic material like concrete by an earthen embankment, which must, from its very nature, compress when it becomes subjected to increased pressure. So far as the comparative safety of the two methods of construction is concerned, a masonry dam has the advantage over an earthen one in the event of it happening to lie in the track of a great waterspout, and perhaps also, though somewhat doubtfully, in the event of its being subjected to an earthquake. But I am not aware of any recorded instance of an earthen dam having been injured by either of these occurrences; and so far as my information extends, the catastrophes in the case of earthen dams have not exceeded in number those in the case of masonry dams, more especially if the greater number of earthen dams in existence be taken into consideration. Some of the failures of earthen dams have been due to the culpable neglect of those having the charge of them to maintain the top of the embankment above the level of the overflow weir; while some of the failures of masonry dams may be attributed to the design having been based on theoretical considerations without a sufficient factor of safety having been provided to cover the many contingencies which an engineer should always allow for when designing a structure. It is also not improbable that the effect of upward lift has in many cases been neglected in the calculations for the strength of masonry dams. In connection with the designing of earthen dams, too much stress cannot be laid on the importance of making sufficient provision for the passage of flood waters during the construction of the embankment, nor to the even greater necessity for designing the overflow weirs and bye-washes of ample capacity to carry off in safety the maximum floods, such as take place, perhaps, only once during a period of from twenty to forty years, and which, even in this country, may exceed by more than 2500 times the minimum flow of the stream on which they occur.

It may be desirable now to glance briefly at the changes which have been made in pumping machinery during the last century. At the commencement of the Nineteenth Century, there were very few impounding reservoirs in Great Britain or Ireland in use for water-works purposes; gravitation supplies being then mostly derived directly from streams or springs—water supplies for towns being at that time principally obtained by pumping from rivers or wells. The pumps drawing water from streams were for the most part driven by water power, while those raising water from deep wells were actuated by steam-engines similar in design to those then employed for pumping at collieries. These engines usually worked with a boiler pressure of less than 5 lbs. to the square inch, and consumed about 10 lbs. of coal per indicated horse power per hour.

The limits of this address will not admit of a detailed review of pumping machinery; but it may be mentioned that it has, during the last century, undergone steady improvement, until, at the present time, pumps are in this country actuated almost entirely by steam-engines, some of the more recent examples of which work with a boiler pressure of from 100 to 150 lbs. to the square inch, and a consumption of fuel not exceeding 2 lbs. per indicated horse power per hour. The pumps themselves have also been improved in construction; those of the bucket and ram type being much used. While some deep wells yield as much as 3 million gallons of water per diem, there are others equally deep which afford a daily supply of less than 150,000 gallons; thus affording ample scope for variation in the design of pumping machinery so as to adapt it to the requirements of the case in which it is to be employed.

Even when water is obtained from deep wells, care has to be taken to guard against pollution from the surface, the more especially as such water is rarely, if ever, filtered. Though water taken directly from rivers has of late years been regarded with suspicion, it is not improbable that rivers as a source of supply will again grow in favour, especially when the conditions of pollution and the safeguarding of the water by careful and efficient filtration come to be better understood and recognized. The advantages of such a source are well illustrated by the case of London, which derives more than three-fourths of its supply from the Rivers Thames and Lea, and the enormous population of which is notably healthy, and has throughout the present year enjoyed an uninterrupted service of water amounting (including water for trade purposes) to no less than 35 gallons or thereabouts per head, and that, too, notwithstanding the serious inconvenience which has been suffered from scarcity of water during the past autumn by the inhabitants of many of our large manufacturing towns depending on gravitation supplies, for the most part under the control of the local authorities.

At the commencement of the Nineteenth Century, water was conveyed to, and distributed in, towns almost entirely by means of wood pipes, consisting of trunks of elm or other trees bored through the centre. Hence, probably, the origin of the expression "a pipe of so many inches bore." Pipes of cast iron were first introduced about the year 1808, and are now almost exclusively used in this country for the conveyance and distribution of water, though in the case of main pipes of large diameter mild steel has recently been employed in a few instances. Whether or not steel presents advantages over cast iron for water-pipes in cases where the difficulty or cost of transport is not of vital importance, time alone will show.

Where very large quantities of water have to be conveyed for considerable distances, a return in some measure to the practice of the Romans is being made by the resort to aqueducts, constructed of masonry or concrete in cases where the contour of the ground is favourable; iron pipes being employed to form inverted syphons where valleys have to be crossed. Where these aqueducts are tunnelled through hills, the tunnels ought to be made of such dimensions as to enable repairs to be executed without interfering for more than one or two days with the flow of water, unless, indeed, there happened to exist other sources from which a supply can be maintained during the period when the tunnel is out of use for repair.

Many matters connected with water supply, which were unheard of at the commencement of the last century, are now of everyday occurrence, such as the treatment of certain waters with lime to

prevent their action on lead communication pipes; the softening of hard waters; the construction of large depositing tanks to facilitate the deposit of matters in suspension, as well as to enable flood waters to be passed by during the earlier stages of a flood, in cases where the water is taken directly from a river; service reservoirs (in many cases covered to protect the water from the action of light and heat, a precaution more especially needed with certain waters derived from wells or taken directly from rivers); and lastly, though not least, efficient filtration through sand filters—a mode of treatment first introduced by the late Mr. James Simpson in the year 1828.

It was during the last century that the supply of water on the system of constant service was introduced into this country, when my father, the late Mr. Thomas Hawksley, in 1830-31 (then only 23 years of age), designed and constructed the Trent Water-Works for the supply of water to his native town of Nottingham, which was the first place to enjoy the advantage of a constant supply; water having been previously provided by another Company on the intermittent system.

With the intermittent service, the waste of water was controlled by the shutting off of the supply after a given time—say, one or two hours—from each of the districts into which the town was divided. But it was soon found that a constant supply could not be maintained with the description of house fittings which had sufficed for the intermittent service; and it became necessary to formulate a code of regulations with respect to house fittings, and to insist on their observance. These regulations were from time to time improved and modified to meet the altered requirements of the day. Parliament formerly left the making of such regulations to the company or local authority entrusted with the supply of water, subject to a right of appeal by consumers to two Justices of the Peace. But unfortunately it has of late years made them subject to the approval of a Government Department possessed of no special knowledge in regard to the distribution of water, and which, regardless of the experience acquired during the past fifty years by men who have devoted their lives to the administration of water-works, now insists on so modifying the regulations submitted for their approval, as to render them impracticable for the maintenance of a constant service. Indeed, I am aware at the present time of several instances in which local authorities and companies having the charge of water-works are refraining from the submission for approval of much needed regulations, preferring to carry on their undertakings with the limited protection afforded by their own and the Public Acts of Parliament than to attempt to fulfil their duties in regard to water supply under the obligations which would almost certainly be placed on them by the Government Department. Such a state of affairs cannot properly be allowed to continue; and I venture to hope that the local authorities and companies entrusted with the important duties of water supply will, ere long, make such united representations to Parliament as will cause searching inquiry to be made into the methods of a Government Department whose procedure, however well intentioned, is productive of so much harm to the public interests, and may, if left unchecked, lead to the destruction in the Twentieth Century of the measures which, during the latter half of the Nineteenth Century, have been so carefully framed for the prevention of the waste of water, and by the enforcement of which it is alone possible to maintain the beneficial system of constant service with any reasonable expenditure of capital.

As there still exists much misconception in regard to the quantity of water required for domestic purposes with a constant service, unrestricted except in respect to misuse and waste, I may here state that, having recently had occasion to collect statistics on the subject from sixteen of the principal towns in England, I found that the quantity of water distributed for domestic and other non-metered purposes was, on the average of six towns supplied by companies, having a total population of 1,185,000 persons, 19 gallons per head per diem; and in the case of ten towns supplied by public authorities, and having an aggregate population of 3,961,000 persons, 18¼ gallons per head per diem. The foregoing quantities provide a constant service for all domestic purposes, including unmetered trade supplies and such waste as cannot be prevented.

I cannot leave the subject of water supply without saying that I am unable to agree with those who hold the opinion that all water-works undertakings should be in the hands of public authorities, who should be empowered to purchase compulsorily all those undertakings still remaining in the possession of companies. I have had occasion in the course of my professional avocations to advise many local authorities as well as many companies in regard to their water-works; and I have, therefore, had opportunities for becoming acquainted with the unsoundness of many of the arguments put forward in favour of the transfer of water undertakings from the hands of companies to those of local authorities—such, for instance, as the control of the breaking open of the public streets, the economy in collection of water-rates, the absence of inducement to make profits, and so forth. My experience teaches that, where the local authority possess the water-works, the Street Committee complain that they have no sooner repaved a street than the Water Committee break it open to lay down a pipe, the salaries in the finance department are raised because of the additional duties which the officials are required to perform, and the desire to make profits at least equals that of a company; while the risks that a local authority are prepared to run by unduly postponing needful extensions of the water undertaking in order to maintain those profits are, in some instances, such as a company would not dare to incur. Should a company lag behind in the performance of their duties, there is the local authority at hand to urge them forward; but should a local authority be supine in the exercise of duties, there is no one to bring pressure to bear on them. The ratepayer is practically helpless. Again, although I do not wish it to be inferred that there are not now many well-managed water-works undertakings in the hands of public authorities, as, indeed, the statistics I have quoted show, the management of such authorities is always liable to be sacrificed to political exigencies—a contingency which does not exist in the case of a company.

[Interpolated between the foregoing and the succeeding sections was one on sewerage and sewage disposal.]

Gas-Works.—The application of coal gas for illuminating and other purposes may fairly be claimed for the Nineteenth Century; for although William Murdoch had directed his attention to the subject in 1792, and five years later had lighted with gas his premises at Old Cumnock, and in 1798 had employed it for lighting one of the principal buildings at Boulton and Watt's Soho Foundry, Birmingham, lighting by gas was first publicly exhibited in 1802, when Boulton and Watt's Soho Works were illuminated by it on the occasion of the rejoicings at the Peace of Amiens. It was not, however, until the year 1813 that coal gas was used for public lighting. This great industry, which was at the beginning of the last century represented by the lighting of a single workshop, has been extended to such an enormous extent that authorized gas undertakings established in the United Kingdom alone have a capital now invested amounting to about £100,000,000; while the gas sold has attained to the immense quantity of about 140,000 million cubic feet annually, and is rapidly increasing, notwithstanding competition by electricity and other illuminants.

To attempt even a reference to the many improvements that have been made in the manufacture and utilization of coal gas would occupy more time than can be devoted to the subject; but it may be mentioned that carburetted water gas has of late years been used in many towns for mixing with coal gas, and that the residual products arising from the manufacture of coal gas have gradually been utilized and made profitable—thus contributing to the reduction which has taken place in the price of the gas sold to the public, which was in London, in the early days of gas lighting, no less than 11s. per 1000 cubic feet for gas of inferior quality, to that now provided at a cost of from 2s. to 3s.

Much attention has been, and is still being, paid by gas engineers to improvements in the mode of heating the retorts, to the question of inclined retorts, to the employment of mechanical appliances for charging the retorts and for the drawing and removal of the hot coke, as well as to other improvements in the manufacture and purification of gas.

Some idea of the development which has taken place in the size of gas-works may be formed from the fact that, whereas in the year 1822, Sir William Congreve, the Government Inspector of Gas-Works reported that at one of London gas-works several of the gasholders were each "of the enormous size of 40,000 cubic feet," the London Gas Companies now possess gasholders having capacities of from 8 to 12 million cubic feet each.

Coal gas is now used not only as an illuminant, but also extensively for heating and motive power. Although for these latter purposes gas as supplied to towns for illumination is mostly employed for the sake of convenience, there are many instances in which, from considerations of economy, a specially made gas of low illuminating power is used. The employment of gas of this nature is likely to become largely increased by the facilities and greater economy which doubtless will before long be afforded by the introduction of Mond gas, the manufacture and distribution of which has during the present year received the sanction of Parliament by the passing of the South Staffordshire Mond Gas (Power and Heating) Company's Act, having for its object the supply of gas—not to be used for illuminating purposes—in large quantities at a price of from 3d. to 4d. per 1000 cubic feet.

It was at first anticipated by many persons that the competition of electricity would greatly reduce the value of, even if it did not entirely ruin, the coal-gas industry. But this has not proved to be the case; the effect of the introduction of electricity having been only to reduce the rate of expansion of gas undertakings. The competition of electricity has moreover proved a stimulus to improvements in the modes of consuming gas—as, for instance, the incandescent burner—and led to greater facilities being offered to the gas consumer, such as by the prepayment meter and the letting on hire of cooking-stoves.

In the earlier part of the Nineteenth Century, coal gas was used only for purposes of illumination; and it was not until the latter half of the century that the invention of the gas-engine made possible its employment for motive power, and that during the latter part of the same period the improvements in gas-fires and cooking-stoves brought it into general use for heating and cooking. It may be mentioned that gas-engines are now made which are capable of developing from 400 to 500 indicated horse power.

There is, in my opinion, little doubt but that the gas industry has still a great future before it; and though it is not easy to foresee the changes that may take place, there appears to be every probability that gas will hereafter be much more largely employed than it has hitherto been for heating purposes, and may thus contribute to the much-to-be-desired abolition of the smoke which now envelopes our towns and manufacturing centres.

Electricity.—Considerable note was made by the President as to the advances which have been made by electric energy—its

application for the transmission of messages, for lighting, and for motive power and traction being dilated upon. One or two general passages from this section may be quoted. The President in one place said: The great advantages conferred on mankind by the development of electricity are accompanied by certain drawbacks, which, though of minor importance, it may be well to refer to. In the first place, there is the undoubted disfigurement of our towns by overhead wires. This disfigurement it is sought to justify on the score of economy—a plea which is not, in my opinion, a sufficient justification, and one which is not allowed to prevail in some other countries less wealthy than Great Britain. The placing of the wires underground would not only prevent that disfigurement, but would also remove the danger—not perhaps a great one, having regard to the comparative fewness of the accidents that occur—attending the use of overhead wires. There is a great opening in connection with electric tramways for a good underground conduit system which could be readily applied in this country. Unfortunately, the heavy initial capital expenditure required for the present conduit system, as compared with that required for the overhead system, has prevented its adoption in all but a few isolated cases.

The reduction in heat due to the employment of electricity for illumination in buildings, has increased the difficulty of ventilation —a difficulty in some instances rendered greater by the absence of any provision whatever for ventilation in rooms where electric light is used.

The danger to gas, water, and other metal pipes by electrolysis was next noticed; but there was no expression of opinion on the subject. It was remarked that the effects of electrolysis are now undergoing scientific investigation, the results of which will doubtless in due time be made known, and may yet become the subject of further inquiry before Parliament.

Conclusion.—In the concluding part of the address, the President viewed with some anxiety and regret (as his father did thirty years since) the discouragement of private enterprise by municipalization, and the formation of public trusts or boards. The question of the standardization of iron and steel sections was discussed; and it appears that the President hopes the time is not far distant when the system of standardization may be extended to many engineering requirements, even to cast-iron pipes—"always, however, bearing in mind that engineering designs must not be reduced to the level of the manufacturer's standards, but rather that the standards must be kept abreast of the requirements of the engineer."

Mr. Hawksley's final words were: There is certainly a great future before the electrical engineer, but engineers practising in other branches of the profession have no cause for despondency; for new fields of activity are being opened in various quarters of the globe. Although British engineers and manufacturers cannot hope to possess in the Twentieth Century that practical monopoly which they enjoyed during a considerable part of the Nineteenth Century, they may still obtain a fair share of the engineering work of the world, provided they adapt themselves in the future more readily than they have sometimes done in the past to improved methods of construction and manufacture, and to the varying conditions and requirements of the inhabitants of many distinct portions of the earth's surface.

A very cordial and spontaneous acknowledgment of the value of the address was made by the members at its conclusion; and formal recognition was also bestowed by the passing of a vote of thanks, on the motion of Mr. Mansergh, seconded by Sir Alexander Binnie.

The awards for papers read during last session were then made; and Mr. H. E. Jones worthily headed the list, for his paper on "Modern Gas Practice," which produced such a vast discussion, both oral and written. Applause greeted him as he responded to the President's call to receive the George Stephenson medal and Telford premium. Among the numerous other recipients of awards were Mr. J. Emerson Dowson and Mr. E. Sandeman, the Engineer of the Derwent Valley Water-Works.

The meeting ended here; but following it was a reception by the President in the Library. Light refreshments were afterwards served; and thus was brought to a close the inaugural gathering of the Institution's new session.

Municipal Gas-Works Leased to a Company.—The transfer of a gas company's undertaking to a municipal authority is an operation to which we have now become accustomed; but the reverse process is less common. An instance has, however, just occurred at Toledo (Ohio). A municipal gas plant was established there about ten years ago, with the result that it has given rise to constant turmoil—mainly of a political character. The citizens in the first place voted $750,000 in bonds for the purpose of going into the gas business; but afterwards additional bonds to the amount of $1,050,000 were issued. There has already been paid about $500,000 in interest; and considerably more will have to come out of the ratepayers' pockets before the city will be free. The people have evidently grown tired of the burden of the undertaking, for they have just leased the plant to the Toledo Gaslight and Coke Company, at a rental of $6500 per annum, with the stipulation that illuminating gas should be sold at 95 c., and fuel gas at 70 c., per 1000 cubic feet. The failure of the municipal plant is stated to be due to opposition from a large number of the citizens, diminution of the gas supply in the wells, and the competition of the Gas Company.

ANNUAL MEETING OF THE AMERICAN GASLIGHT ASSOCIATION.

The President's Address.

As stated last week (p. 1166), the American Gaslight Association held their twenty-ninth annual meeting in Boston (Mass.) on the 16th and 17th ult., under the presidency of Mr. EDWARD G. PRATT, of Des Moines (Iowa), who, after a few and feeling remarks with reference to the recent assassination of Mr. M'Kinley, delivered the following Inaugural Address.

It has been the custom of my predecessors, I believe, to briefly review what has transpired during the year, what successes have been attained, and to declare for the future, so far as present indications may suggest. In retrospect, therefore, what has been accomplished during the year that is worthy of mention here? It is certain that we are working along conservative lines, and that progress is being constantly made; but nothing startling has been developed or accomplished. In manufacture, we believe that money is saved here and there only where attention is given to details. In truth, the difference between good and ordinary results may be gauged by either indifferent or close attention to minute details; and it goes without saying that the superintendent or manager of a works must have the education, inclination, and disposition on his own part, backed by the assistance, appreciation, and liberality of his superiors, and the interest and co-operation of his subordinates and those in his employ, in order that he may be in such a happy condition as will enable him to analyze his work from day to day, and to discover here and there where the details to which I make reference can be improved on.

At the present time, we hear much about drawing and charging machinery, and inclined retorts for the large coal-gas works of this and other countries; and I doubt not that for such works this sort of machinery and construction will be adopted where not now in use. But who will say that, for the average-sized gas-works of this country, either would be applicable from the standpoint of economy? I do not wish to be understood as saying that such appliances and construction are not practicable, even for small works; but up to the present time, so far as I have information, neither, for obvious reasons, I believe would be profitable. There is opportunity for the average-sized works to develop or improve its mechanical devices for the more economical handling of coal and purifying material, and where the preparation of coke for the trade may be reduced to the minimum. I do not mean to convey the idea but that this is being done at many works—possibly at more than I have knowledge of; and yet with what I have seen, there is a chance for improvement along these lines.

During the past three years, there has been a decided advance in the price of oil for gas-making purposes, which advance, and the fact that coal prices were down in 1899 and 1900, caused many gas managers to either revive their old coal-gas benches or to build new ones. These changes, where changes have been made, were, during this period, of practical advantage, especially in localities where the standards of candle power required were not so high as to make the exclusive manufacture of coal gas prohibitive. And yet during this period of high-priced oil and low-priced coal, I have it upon good authority that the number of water-gas machines and their aggregate capacities have been increased each year during the past three years. This may be due either to the great energy displayed by manufacturers of water-gas apparatus, to the comparative cheapness of such apparatus over modern coal-gas installations, or to conditions depending upon locality, but presumably because it has become a well-defined policy by the gas companies of this country that, in cities of 30,000 people and upwards, the interests of their patrons would at all times be better served by having both types of apparatus at their command.

Concerning the price of oil, it is undoubtedly true that the tendency to advance rates has received a check by the recent discoveries of oil in Texas. Whether this oil will be economical for us to use, will depend upon price and the results of trial, to be determined by experiments and experience. Elaborate experiments in the use of Texas oil have been made at the works under my management during the past summer; but the conclusions reached, as a result of these experiments, and in comparison with other oils, I am not prepared to make public, for enough information is contained therein to furnish material for an instructive paper. Certain it is that the discovery of oil in Texas has had a stimulating effect in the erection of new water-gas apparatus. The estimated daily output of the Beaumont, Texas, oilfield is 700,000 barrels, although doubt exists in the minds of those who are in a position to know as to the correctness of the statement. But, comparing the estimated daily output of the other oilfields outside the Beaumont district (160,000 barrels), and making a liberal allowance for the former estimate, we cannot but conclude that any further advance in present rates for oil is, to say the least, very remote. The permanence of the so-called Beaumont "gushers" cannot be predicted; but the discovery of oil there will undoubtedly stimulate a large amount of prospecting all over Texas, and the belief is that other paying "strikes" will be made in the near future.

There appears to be no diminution in the quantity of good gas coal in sight; and as the price of this product is regulated almost

entirely by rates for transportation—the cost at the mines remaining almost constant—it would seem, in view of the circumstances, that railroad companies may, and undoubtedly will, make rates to enable those remote from water transportation to still seriously consider whether it shall be coal gas, water gas, or both.

The item of purification is now such a small one, as compared with former years, that, while new schemes have been advanced in the number, arrangement, and construction of boxes employed, the notion prevails that, with four boxes of ample size, a good quality of oxide, and convenient means for handling it quickly, we should hesitate a long time before adopting anything different.

The market for residual products continues good, and especially that for coke. The demand for the latter is, of course, in a large degree due to locality, and controlled by the price of anthracite and bituminous coal in that locality. But there is very much in educating people to an intelligent and economical use of coke in whatever sort of appliance it is to be employed. I wish to emphasize the word education as used in this sense, for I know from experience that much can be accomplished in this direction. I presume there is more ignorance displayed by the average individual in using any heating device requiring fuel, and especially in the economical use of coke, than in almost anything else.

Upon the important question of storage, we find that, even though ample holder capacity is an excellent precaution, we can run much closer to any demands made upon our works than formerly; and this condition has been brought about principally by the introduction of water-gas apparatus. It might also be truthfully said that the successful distribution of gas under high pressure eliminates in a large degree the necessity of having holder capacity so much in excess of daily needs as was formerly requisite.

There is a disposition among present-day writers, supplemented by the opinions of men advanced in the business, to substitute another standard for the one so long in use, and the one we have held so much in reverence—to wit, candle power—and to substitute therefor heating value or the heat unit. And with this disposition comes the suggestion of a lower illuminating power; and why not, since the tendency is almost universal toward the use of the Welsbach or some other type of incandescent gas-burner? Why, unless compelled by some Legislative Act, is it necessary for us to distribute to our consumers a gas of (say) 20, 22, 24, or even higher illuminating value, when, with a gas of (say) 14, 16, or 18 candle power, and the use of the Welsbach or a similar type of burner, there can be obtained nearly equal results for our consumers, and certainly increased benefits to ourselves? We may not at once agree with Professor Macadam, who, in a lecture delivered before the North British Association of Gas Managers,* says, referring to the Welsbach burner: "The light is not obtained from the constituents of the gas, except indirectly from the heat of combustion. A perfectly non-luminous gas, or a very low candle power gas, provided it in burning gives a sufficient amount of heat, should furnish just as good a light result as a high-quality gas;" and yet the statement is undoubtedly true. If, therefore, as seems to be a fact, the tendency is for a new standard, it behoves us to keep in mind any legislation bearing upon this question, or, for those of us anticipating in the near future a renewal of franchises or the seeking of new ones, to see to it that the standard agreed upon, whether it be a lighting or heating value, is such as will enable our enjoying the benefits which seem now to be in the air, and which, though to some may seem a step backward, yet, in the "march of progress," are destined to be upon us before possibly we are prepared for them. There is much that may be said in favour of such a new standard as has been referred to, and a lower candle power; but both have already received the attention of eminent writers, and enough remains to furnish material for a paper by some member of the Association who has given the subject more thought and study than that indicated by the brief allusion I have made to it.

The past year has been a notable one for extensive improvements and repairs, both at works and to our distributing systems. This is explained by reason of great reductions in the prices of all materials entering into the construction of new work; also because all work that could possibly be postponed last year and the year before was held up on account of these high prices, and because the constant growth of our business has made it imperative that we be prepared to meet the increasing demands. Our distributing systems have been extended, either for new business into new territory, or augmented so as to render better service in the territory already covered. In many of the cities and larger towns represented here, I believe both have been necessary; for there seems to be no limit to the demand for gas in our respective communities. Naturally, we inquire as to the cause of this increased popularity in the use of gas; and we are compelled to answer that it is because of the neglected education of our consumers already secured and prospective, for we have only recently awakened to the fact that our business has not been conducted along the same progressive lines as have other manufacturing industries. It has only been during comparatively recent years that we have exerted ourselves to find a market for our product.

Heretofore, we had devoted most of our time and energies towards securing economical results at our works by saving here and there a few cents, or possibly fractions of cents, in the cost of gas in the holder; believing that when this was done, coupled with some attention to leakage, we had performed our duty faithfully and well. Many of us are familiar with the methods employed formerly in computing the cost of our gas. The holder cost, multiplied by two, was generally considered as a reasonable estimate of the cost at the burner. It is evident that such a method would not now be a safe one to depend upon; for, while the cost of manufacture has been greatly reduced in recent years, the cost of distribution has been largely increased, due to more liberal methods being employed to secure and hold business—for we are ever on the alert for new schemes and ideas that will enable us to increase the sale of our product. Witness our efforts in this direction. We have offices that are a credit to any community, equipped with attractive furnishings and fixtures. We display gas-consuming devices of all sorts, kinds, and descriptions, in a manner that is the envy of the retail merchant; and we employ competent salesmen and saleswomen, who are peculiarly and particularly adapted, not only to sell these devices, but to give instruction in their use. We advertise our wares and their use in daily papers and magazines, on bill boards, theatre programmes, and in every other way that we believe to be judicious methods of advertising. We seemingly do everything to keep the use of gas before the people. We keep solicitors in the field the year around, and can tell at any moment, from the reports of these solicitors, who upon a certain street do not use gas, and why they are not using it. Encouraged by the knowledge that our product has passed beyond the stage of luxury to that of necessity, and coupled with the fact that the majority of us are selling at a rate that will enable everybody to use gas—which rate has either been established by ourselves as good business policy, or through compulsion brought about by local conditions—is it any wonder that the limit of our business and the territory to be covered seems just as far off now as it did several years ago? The wealthy and the well-to-do classes in our respective communities are now supplied, except such as may locate and build later on. Our business now, therefore, is to educate and supply those possessed of less of this world's treasure; and I doubt not but I express the opinion of most of you, when I say that this is desirable business, and the kind that is worth looking after, because this class of people are masters and mistresses of their own households, use only what they can afford to pay for, and pay for what they have—and usually without complaint. In saying this much upon the question of selling gas, I realize that I am trespassing upon a paper that will presently be presented by a gentleman who knows all about the subject assigned to him; but I cannot refrain, since it suggests other thoughts.

It is pleasing to contemplate that, by the efforts put forth to introduce gas engines, stoves, ranges, water-heaters, &c., we have brought our day consumption up to a point where in many instances it far exceeds the night consumption; and yet we must not forget that we are in the lighting business as well, and that no opportunity should be lost, either to hold old consumers or to secure new ones. We have had competition with electricity in the past that was disastrous to the companies furnishing it, because it was illegitimate—due to the then prevalent custom of selling current by contract, and, therefore, with no very clear conception of the cost of supplying the consumer. I believe I am safe in saying that there has been a marked change in such methods, and that now it is the exception rather than the rule where electric current is sold by contract. Electric companies have found out that, for their own protection, and as a business proposition, the only way their business can be conducted is by the use of the meter. Hence, competition with electricity for light becomes a legitimate one; and, under the circumstances, our judgment is that gas companies have nothing to fear.

We must not forget that we are in the business of furnishing light as well as fuel and power. That electric companies are upon a firmer basis than in the past, cannot be disputed; and it is gratifying that it is so. They have also made rapid strides in the economy of operating, due to the general adoption of slow-speed condensing engines coupled direct to the dynamo, and by the installation of larger units, as well as the development of the polyphase alternating system, and the introduction of the enclosed arc lamp, particularly for street lighting. As a result, the electric plant of to-day can be designed on lines of greater simplicity as to system, and can attain far greater economy in operating.

The disposition to consolidate gas and electric properties in smaller towns and cities is, I believe, good business policy, inasmuch as the tendency to cut rates for either gas or electricity below what is profitable is avoided, as under united management reasonable rates for either that will be profitable can be made and maintained. It is in the field of light and power principally that we meet our electric competitors, if such they can now be called; for we are disposed to believe that, as the years pass, the lines are not so tightly drawn. Each has its sphere of usefulness, and both are making more rapid progress in the development of their respective business, and in the service given, than if either were in full possession. The situation is an extremely interesting one; and we look forward to the future with a full realization that it will be necessary for us to understand, and take advantage of, our opportunities.

Through the instrumentality of the Welsbach and other incandescent gas-burners, we are able, by giving a superior light and a cheaper one, to more than hold our own, provided we give to the incandescent gas-burner such attention as it requires to render efficient and satisfactory service. And in this connection, it is well to emphasize, what probably most of us have found out, that it pays to inspect the burners and mantles, and to undertake to keep out of the field anything and everything but the best. There

* See *ante*, p. 278.

is opportunity here also for the education of our consumers. If we could but establish their confidence to the extent that they would rely upon our statements as to the efficiency of certain burners as compared with certain others, and not to be "buncoed" by travelling dealers, whose only object is to sell their burners without care as to the results which may follow, we would have achieved much in the right direction. This I believe will be accomplished in time; but it will require everlasting diligence on our part, and it means that we must keep the right sort of men in the field all the time to assist in doing it.

If in competition with electricity we can give more light for less money, it behoves us to look to the comparative convenience of gas; for we admit that, for convenience in lighting and extinguishing, and for certain decorative purposes, the electric light is superior to gas-light. But cannot the difference of convenience be reduced by the installation of electric gas-lighting devices? These have been introduced in the larger cities, more especially in the East, and in reality are no new thing; but in the smaller cities and towns, particularly in the West, I doubt if they have received the attention to which they are entitled. I believe it would pay any well-regulated company to have in their employ a man competent to furnish estimates and perform this class of work in conjunction with house-piping and fixture business.

Gas lighting by means of chain bye-passes is convenient, but not absolutely satisfactory, especially where used in conjunction with the Welsbach burner. So-called self-lighters are on the market; but these must, and undoubtedly will, be improved upon before they can be generally used with satisfaction. The introduction of all such devices should be encouraged, and not too quickly condemned; for be it remembered that the Welsbach burner would have been short-lived if its early existence had depended upon the approval of its patrons or the enthusiasm of ourselves. Its success was due to the energy and persistence of those who had faith in the future of the burner; and to them our thanks are emphatically due that we are to-day able to perform so large a percentage of the lighting business.

It is pleasing to note that we are making progress in the introduction of gas-engines; and while we are still handicapped on account of the first cost of installation as compared with the electric motor, yet we are able, by reason of the smaller cost of operating per unit of power furnished, to place an occasional engine, and this occasional engine means the addition of others. To make satisfactory progress in this respect, my advice would be to first select the best engine we have any knowledge of (not the cheapest), and beware of the engine that may be converted quickly from a gasoline to a gas-engine, or *vice versâ*, for they are not to be depended upon for economy. Select from your force a man, if you have one, competent not only to talk gas-engine, but who is also thoroughly posted in its operation—one who is able to figure the relative cost of operating with steam, electricity, or gasoline. Each engine installed should be inspected at intervals, so as to discover any defects (if any exist), and to remedy them. In my experience, the average user of a gas-engine has little regard for the cleanliness of the machine or the surroundings. In his judgment, it is necessary only to give it oil (any kind will do), to turn on the gas, and let it go until he is ready to stop it; and the same method of operation is pursued day after day. It would seem, therefore, that our business from the time our product leaves the holder until registered on the meter-dial, is one of education—education that means an expenditure of money, thought, and energy, but which, in the light of present and anticipated results, will pay.

I will refer briefly to the question of gas for street lighting, which for a number of years seems to have been relegated to the rear rank, but is now, in the march of progress, we are happy to note, gradually working itself to the front again. The public, always in a receptive mood for the newest and latest things out, saw in the electric arc lamp a light that would convert darkness into daylight. Hence cities and towns made haste to adopt this new method of lighting—generally without regard to cost. It has had its trial and served its purpose, to the extent even of displacing in many towns and cities all the gas-lamps originally in use. But it has been discovered that too much light in some places and none in others—and especially in the residential portion of cities—is not satisfactory, and that the more even distribution of light by the gas-lamp, and beneath the foliage, is preferable. It has also been discovered that where gas is employed the bugs and insects, and "every creature which is on the earth and under the earth, and such as are in the sea," do not reach that size and magnitude, and are not so numerous—that they fall down in heaps to be carried away by the scavenger the next day.

We admit that every arc lamp placed in the business portion of the city is equal to a policeman; and we are unmindful if companies furnishing them do receive as much compensation therefor as the average policemen receives. But, in the light of the present day, we are not willing to admit that, for residence street lighting, the electric arc lamp as usually placed, is the equal of good gas-lamps fixed at intervals of (say) from 100 to 150 feet apart, having flat-flame burners and consuming gas at the rate of 6 cubic feet per hour—the lamps to be of an attractive design, kept clean, and in good repair. This leads me to suggest that we are by no means dependent upon the flat-flame burner for street lighting; for incandescent gas-burners, enclosed in lanterns especially adapted for their use, have made, through the energy of those introducing them, and because of real merit, very satisfactory progress. And I have it upon good authority that these have been placed in many of the larger cities of the country, to the total number of 100,000, and with prospects for their continued rapid increase. I am sure that the satisfactory results given by these lamps may be attributed to the care and attention they receive; and it is evident, from the number placed, that they are giving satisfaction in communities where they have been installed. These lamps are placed at an average distance of 150 feet apart; the price depending upon the price charged for gas. Those of you who have seen a street lighted with Welsbach lamps know how favourable the comparison is to the street where electric arc lamps are used, especially if employed in a residence section.

Concerning acetylene lighting, I understand that at Niagara Falls and Sault Ste. Marie carbide is being made in large and increasing quantities—indicating that there is a demand for it somewhere. It is probable that this demand comes from towns too small for the profitable operation of a coal or water gas works; and there being many such, little doubt need exist but that this industry has a bright future. I learn that the gradual and continued reduction in the price of carbide makes it possible for acetylene to be produced cheap enough to attract attention of town councils for lighting streets and public buildings.

In passing, it may not be out of place to mention that the question of electrolysis has received such vigorous attention in different parts of the country that street railway companies are giving great care to their construction work, both on new lines and by the repairing of old ones, so as to obviate or reduce to the minimum, as far as present information will enable them, any electrolytic damage to underground gas or water pipes.

The question of the taxation of public franchises is one that always confronts us, and, like Banquo's ghost, "will not down." Yet it is strange that it should be a never-ceasing source of trouble and discussion. A franchise is simply a privilege, a right, and is not property. The State grants the right or privilege, which is an intangible something, and surrounds it with all those limitations and conditions deemed necessary for the protection of the public. After this is done, it immediately taxes, not alone all the property belonging to the corporation holding the franchise, but the very privilege it has just granted. The State, in granting the franchise, retains the right to control it and fix all charges in connection with it. The Courts hold that the State retains the right to determine all charges and tolls—thus leaving the value of the franchise at the absolute mercy of every municipality. Then, having done this, it attempts to exercise the right of taxing, if necessary, this very public franchise out of existence. In this way, every corporation engaged in a public utility is subject to two methods of spoliation at the hands of municipal bodies. Does the treasury need money—the taxing body imposes a tax upon the franchise as it seems fit. Do the people demand a reduction in the charge for gas, electricity, or the like—the municipal authorities proceed to at once reduce the price to the consumer, so that the receipts are reduced at one end while the tax for the privilege to do business remains the same or is increased.

It is now conceded that the sovereignty retains the power to fix the charge for all public utilities at such a figure as shall yield reasonable returns on the investment, not upon the investment with the value of a supposed franchise added. Yet, while we are allowed to earn only a return on the actual value of the tangible property, we are taxed on the value of the franchise for which we are entitled to no consideration in fixing our earnings. It is clear from this that a franchise is not, and ought not to be, a subject of taxation. The privilege granted to furnish gas is for the benefit of the general public as consumers; and the public should have the benefit in the fixing of a reasonable charge for the commodity, but not the municipality in the way of a tax.

Much has been said and written concerning profit-sharing and building and loan associations, for the benefit of employees; and also as to methods and measures for the better care of workingmen employed in large manufacturing concerns in general, and in and about gas-works in particular.

Many of us, I presume, have had a theory favourable to such a measure as "the better care of working men;" but we must confess that the theory has been often shattered, and especially so in the light of recent events. We are led to believe, however, that there must have been something wrong somewhere, when the employees of such an institution as the one at Dayton, Ohio, employing 2300 people, surrounded by everything seemingly calculated to make the labour of an employee light and easy—the "model factory" of this country—should strike, for the reason that four of their number were discharged for some cause. And yet, many of us looking back over the years when we were less fortunate than now, can say from experience that we would have appreciated any effort on the part of our employers that would have made our burdens less heavy to bear. Gas companies have not been, and are not now, hampered with labour or industrial unions; the men grow up in the business, are well paid, and as a rule are satisfied. But, realizing the feeling of unrest on the part of labour in certain sections, the extent and importance of which seem to be growing with the commercial growth of the country, and in nearly every industrial pursuit to organize for so-called "protection," would it not be well for directors and managers of gas companies to seriously anticipate what is happening, and to consider ways and means which will continue that friendly relationship which we believe now exists between employer and employee of gas companies in this country? Consider the men employed at the works, especially in works where coal gas is made, and it will not be disputed that their labour, while intermittent,

is nevertheless hard; and very much more intelligence is required than is possessed by most of them to know how to take proper care of themselves under existing conditions. They perform the duties assigned them, get heated, sit or lie down in a draught, and consequently, in disobedience to the laws of Nature, pay the penalty of such carelessness with shortened lives.

Why not set apart at our works, whether for coal or water gas manufacture, a room, ample in size, to which the men, as they may be spared from their labours, can retire. Such a room should be equipped with lockers in which their good clothing—such as they would wear to and from their work—could be kept; each man being assigned his own locker, and being held responsible for its order and cleanliness. In this room, or another convenient thereto (depending upon the size of the works and the number of men employed), there would be a bath-tub and shower-bath, and other toilet conveniences; the foreman of each shift to be held responsible for the cleanliness at all times of such a room, and the appurtenances therein. We might go even farther, and provide facilities with which they could heat their tea and coffee, or other articles of food requiring heating or cooking. In addition to this, we could reserve (if only a small portion of the yard) space where grass could be grown and kept green with a few shrubs scattered about, and possibly a few flowering plants. No man fit to be employed about such an establishment could but appreciate these things; and the expense in keeping them up would be insignificant. The condition of affairs, I know, would be in striking contrast with many of the works I have in mind; for, sad as it may be to relate, there are gas-works in this country that I know of whose managers do not provide even decent tools with which to perform the work, and the results there are usually commensurate with what the workmen have to do with.

This liberality on the part of the management might be gradually extended to the office and shop employees (especially if both office and shop were in the same building), by the setting apart of a suitable room, neatly and substantially furnished, equipped with a billiard or pool table, or both; also a library table upon which could be found the daily papers, and some of the leading magazines and technical journals, such as relate to mechanical and scientific questions, and to the gas business. Here employees could congregate of an evening to read, smoke, or talk, and in other ways amuse themselves. Such a room, once established, I am sure would be willingly maintained by the men making use of it, by small monthly or weekly subscriptions. The limit to which such a room and its contents could be extended, would depend, of course, upon the number of employees to enjoy it. The questions you are undoubtedly asking yourselves are, Would all this pay? Would it be appreciated? Why not try it, and find out; the experiment may be tried piecemeal, and would not cost much.

Mr. Nettleton, in his admirable address in 1887, referred incidentally to profit-sharing. This is by no means a new question, for it has been successfully tried by large manufacturing concerns in Europe, and in a few instances in this country. The only gas companies I know of as having given any plan a trial are the Columbus Gas Company, of Columbus (Ohio), and the Grand Rapids Gas Company, Grand Rapids (Mich.), upon a plan devised by Mr. Emerson M'Millin. This plan consisted of "additional compensation for continued and faithful service in the shape of non-interest and non-dividend bearing scrip," which scrip was "redeemable only in the shares of the capital stock of the Company when presented in sums of $100 or any multiple thereof." Provision was made, "that when any employee shall have received from the Company direct, or have acquired by purchase from others, the aggregate sum of $300 of such scrip, such employee may then, so long as he continues to hold such scrip or the equivalent in the stock of the Company, at his option, receive any further reward in cash." I understand that the plan, in that comparatively few of the employees of the Company became actual stockholders, was not altogether satisfactory; yet "the effect of the plan was good, both upon the employee and to the credit of the Company in the community." This scheme, while worthy of commendation, is not, it seems to me, altogether the right one, inasmuch as it admits of the barter and sale of scrip, in which transaction the more shrewd individual would receive the benefits which were not intended for him. A plan that would give quicker returns in the shape of non-transferable stock or scrip, upon which dividends would be paid in cash, or the actual payment of cash, would, it seems to me, put the matter in such a shape as to give those the benefit whom we were seeking to reward. Would not some plan that would make an officer or employee of a company feel that he had an interest in his employer, beyond that which he had to give in return for his compensation, be desirable?

The question of profit-sharing suggests also the establishment of building and loan associations for the benefit of employees. Like the other, this is not altogether a new idea, although I am not advised that such an organization has been created for the benefit of the employees of gas-works, except in St. Louis (Mo.). I understand that there an Association was started, primarily for the benefit of the employees of the Company; but as they could not subscribe for all of the stock, outsiders were permitted to come in on the same terms. The admission of outsiders is, it would seem to me, an objection to the plan; and if necessary to the success of the Association, I would consider such a plan not as desirable as some other that might be devised. The purpose of this Association was the accumulation of a fund from monthly dues, premiums, interest, fines, &c., which fund should be loaned to its members, or to persons not members, for the purpose of enabling them to erect or purchase homes. I understand that the following, in brief, is what was accomplished, in part, at the end of the first hundred months, omitting all outside stockholders: "Five employees cleared off mortgages amounting to $17,200, the interest paid by them to the Association for loans averaging 3¼ per cent.; 14 employees who did not borrow on their shares realized $11,803·56, paying them an average of 9 per cent. for the time their money was invested; 21 employees have loans aggregating $37,600; and 75 employees own 790 full shares, representing an investment of $30,000. And this does not represent the amount to which the Association has been patronized by the employees, because so many of them remained in for the purpose of accumulating a little money, and then drawing it out to use for other purposes than building." Many of the members admit that they would have had nothing to-day were it not for the dues paid in. An Association of this kind certainly tends to keep the men satisfied, for they feel that their interests are being cared for, and the little money they are able to save is safely invested; while others would never have obtained a home but through this method. I have referred to this Association with which I have acquainted myself, for I believe that it is worthy of consideration, and possibly of imitation.

In line with these suggestions, it certainly will not be out of place to refer to that most excellent work inaugurated and now being maintained by this Association. I refer to the School of Correspondence. This is, without doubt, the best work carried on by any similar Association in this or any other country, and it stamps the American Association as being at the head of all others, in doing for the young men in our employ what they cannot but appreciate; for it presents opportunities of inestimable value, and such as many of us would have so enjoyed the benefits of in our early experience. The work of this Correspondence School should never be allowed to lag for want of support; and when the time comes for the renewal of subscriptions, I am sure that there will be no difficulty in realizing even more money with which to carry on the work than when the plan was first promulgated. The establishment of an Association Library is to be commended; and every assistance possible should be given the Secretary to help carry on the work of what now is but the nucleus of that important part of our Association, for it will assist materially in its permanency.

There will be a report made here by a Committee appointed a year ago upon the question of some general policy of advertising; and I shall endeavour to have it brought up so early that it may receive your thoughtful and candid consideration. Briefly, a similar Committee were appointed by the Ohio and Western Associations; and these Committees have made their reports. The plan is to devise some satisfactory method by which knowledge of the various ways in which gas can be used will become universal, and by which means every company contributing will be benefited by the experience of those who know how to advertise. In some such way as may be proposed, all are benefited in general, and each in particular.

In this connection, it appears to me that it would be advisable for the Association to take steps at this meeting, looking toward some concerted action on the part of builders of gas apparatus and manufacturers of gas-consuming appliances, to make a creditable display at the World's Exposition, to be held in St. Louis, in 1903; and I recommend the appointment of a Committee of five, whose duty it shall be to represent the Association and to co-operate with other Gas Associations, if need be, to secure space in which there shall be a display of all gas-making and gas-consuming devices of all the manufacturers who may be prevailed upon to enter. It might not be practicable for gas-making machinery to be erected, except in miniature or by models; but the whole scheme appeals to me as one that would attract the attention of the public, and would be a most excellent exemplification of what the condition of the gas business in this country is at the present day. It is not difficult to imagine that arrangements could be come to whereby great good might be derived to all concerned by such a display as could be made.

Asphalte and Manjak in Trinidad.—According to a recent "Board of Trade Journal," the principal deposit of asphalte is at La Brea. The Pitch Lake there is 110 acres in extent, of unknown depth, and situated 130 feet above the level of the sea. The removal of 1,720,000 tons of pitch during the past 34 years does not appear to have made any impression on the lake. Manjak, a variety of pitch, has lately been discovered in quantity about ten miles to the north.

Southern District Association of Gas Engineers and Managers.—A good programme has been arranged for the meeting of the Association on Thursday. Attention will first be engaged by the election of the officers for next year and new members; and then three papers will be read and discussed. In the first, Mr. Charles Carpenter will recount his further experience with reversible condensers; in the second, Mr. T. Randolph Murray will tell the members of certain experiences encountered during the alterations to the connections of an 80-feet diameter water-gas relief holder and tank; and, in the third, Mr. A. W. Onslow will again give information on the subject of high-pressure lighting, which presumably will be supplementary to his previous communication on the same topic.

INTZE GASHOLDERS AND TANKS.

A Recent Improvement.

In view of the interest that has been excited in gas circles by the publication in our pages of the paper by Heer J. van Rossum du Chattel, descriptive of a gasholder recently erected in Amsterdam on a modification of the principle of construction identified as the "Intze,"* a more extended abstract than usual of a patent taken out last year by Herr Otto Intze, of Aix-la-Chapelle, may be desired by our readers. The patent is No. 23,513; and it is dated Dec. 22, 1900.

The invention, says the patentee, relates to the construction of annular sheet-metal tanks for gasholders, which (especially in the case of tanks of large dimensions) presents various difficulties when it is desired to carry out the walls cylindrically in ordinary sheet-metal construction. The outer cylindrical wall of an annular tank—being subjected to annular tension—must, for large gasholders, as also for ordinary full tanks, be strengthened to such a considerable extent in the lower plates, that the constructor is very much limited, as regards the size of diameter of the tank and the height of the walls, by the necessary thickness of the plates, and also by the difficulty of fishing the joints of the plates without too great an expenditure of material, and without weakening the joints too much by the rivet-holes. The inner wall of an annular tank, being subjected to annular compression, requires (in order to be secure against rupture) such considerable expenditure of material, that the strain-resisting capacity, as theoretically calculated, is only slight compared with what would otherwise be considered as admissible. The tendency of recent years to construct specially large tanks in metal, and, at the same time, to give them the utmost possible stability, while weighting or straining

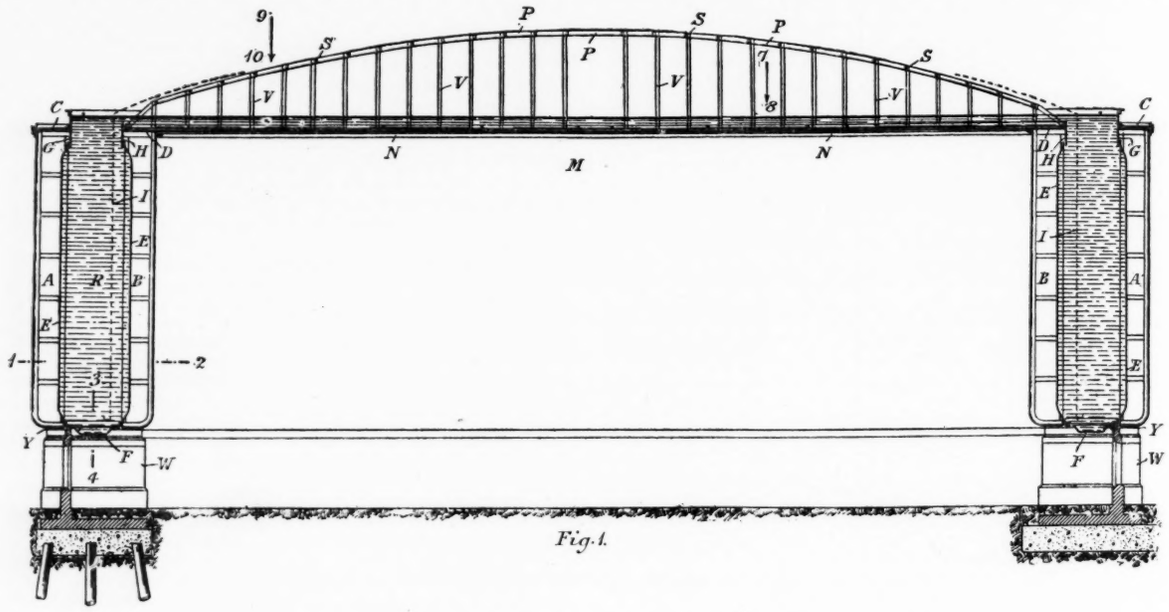


Fig. 1.

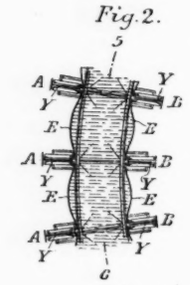


Fig. 2.

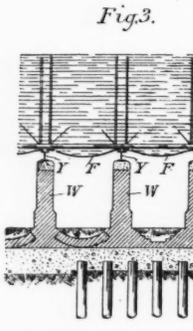


Fig. 3.

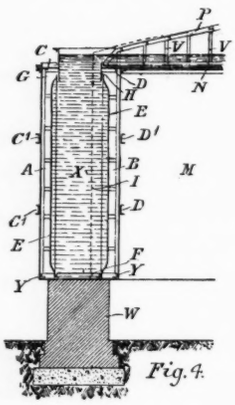


Fig. 4.

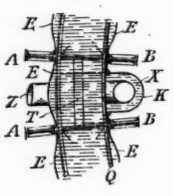


Fig. 5.

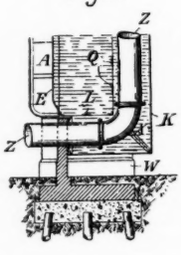


Fig. 6.

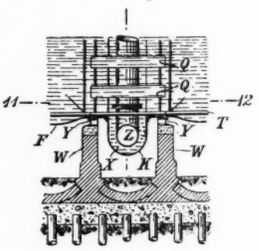


Fig. 7.

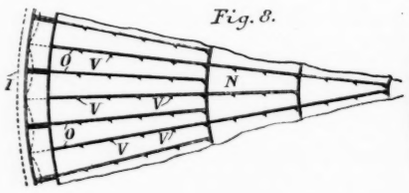


Fig. 8.

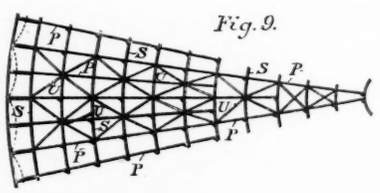


Fig. 9.

the ground as little as possible, has led to the present invention, which "allows of very large diameters of tanks being chosen, and, at the same time, of the walls and other constructional parts being made of proportionately thin plates, and not too heavy figure iron. The material can further be utilized up to its highest possible admissible strain-resisting capacity, and the tank can be erected in a simple way after the largest and heaviest elements of construction have been almost wholly prepared in the shops. The simplifying of the erection enables the necessary time for the same to be shortened; and the invention itself enables a much cheaper and more reliable carrying out of such constructions."

Fig. 1 is a vertical cross section of the tank. Fig. 2 is a horizonal section on the line 1, 2 of fig. 1. Fig. 3 is a vertical section on the line 3, 4 of fig. 1, or on the line 5, 6 of fig. 2. Fig. 4 shows a partial cross section of a modification of the tank. Fig. 5 is a horizontal section on the line 11, 12 of fig. 7. Fig. 6 is a vertical section on the line 13, 14 of fig. 7. Fig. 7 is a vertical section of a part of the lower portion of the tank. Fig. 8 is a plan view of the bottom of the tank, as seen in the direction of the arrow 7, 8 of fig. 1. Fig. 9 is a plan view of the framework supporting the tank bottom, as seen in the direction of the arrow 9, 10 of fig. 1.

The annular tank is constructed of elements "congruent to each other," each of which consists of two rolled or riveted vertical pillars A and B and a horizontal girder Y, or any other suitable cross-connection binding the lower ends of the pillars. By this lower cross-connection, the greater part of the water pressure, which, in the case of pillars only held above and below, bears with two-thirds of the complete column on the lower supporting points of the pillars, is taken up, while the forces of radially oppositely placed pillars, which are directed in opposite directions to each

* See "JOURNAL" for Sept. 17, p. 706-13, and subsequent correspondence.

other, are almost wholly equalized, "so that heavy and costly annular bottom constructions are not necessary."

The vertical pillars are connected horizontally at their upper ends (as in fig. 1), and, if necessary, also between their upper and lower ends (as in fig. 4), both exteriorly and interiorly, by means of rings C and D, which offer to the pillars the necessary support against the horizontal water pressure. The two vertical bays or spaces between two neighbouring elements are closed by bulged or bent plates E; the third horizontal bottom space being likewise closed by a freely-suspended bent or bulged plate, or by a flatly-laid plate F. The inner and outer walls of the annular tank are thus formed by the plates E, and the bottom of the tank by the plates F.

As these bent or bulged plates can receive a very small radius of curve or bend, the thicknesses required are only slight. Seeing, further, that the strength of the elements or frames formed by the pillars and cross girder merely depends on the height of the wall or water-column, and on the distance of the elements from each other, and that the thickness of the bent plates is merely dependent on the small radius of the bend (which is always kept the same size for tanks of varied sizes) and on the water-column, it is not necessary to alter the strength of these elements and of the curved plates closing them with the diameter of the tank, and, "in consequence, large diameters of annular tanks can now be taken in hand which hitherto have not for practical reasons been used." Only the binding-rings fitted to the upper ends of the wall-pillars or the intermediate rings must be strengthened in proportion to the diameter of the tank.

Seeing, however, that at most one-third of the horizontal water pressure on each wall-pillar is transferred to the upper binding-rings when they are arranged alone—that is, without the use of intermediate rings—these rings can be constructed without requiring iron parts which, even in very large tanks, could not be joined in a simple manner. In this arrangement, the upper parts G and H of the annular walls, which are under little strain, can be constructed cylindrically of thick plates, and advantageously made to serve as parts of the binding-rings C and D.

The form of the elements of the annular tank can be modified as in fig. 4, by the connection or binding of the vertical pillars A and B at the lower end being effected by means of a sufficiently strong flat plate F, which is supported directly by the foundation pillars.

The resulting bulging out in opposite directions of the plates of the outer and inner walls of the tank, as in the present invention, allows—both during erection and also after the gasholder has been finished—of the shell of the holder I (shown in dotted lines), and also the lower guide-rollers, being easily accessible.

In order to limit the width of the annular tank as much as possible, so far as the arrangement of the holder admits of this, the inlet and outlet gas-pipes *Z* are arranged in a special way, while retaining the nature of the elements of the tank as previously described. For this purpose, the bays are extended at the bottom and on the inner wall of the tank by means of plates K, with a large bend, formed essentially like a half cylinder (figs. 5, 6, and 7) or, although less advantageous as regards the necessary thickness of metal, like a prism. By this arrangement, it is possible, even in very narrow annular tanks, to so carry very large inlet and outlet pipes *Z* through the extensions communicating with the water-space R of the annular tank, and filled with water, that the pipes are not in the way of the holder I, and are yet completely covered by part of the water of the annular tank itself. The complete immersion of the pipe *Z* in water is necessary, in order to prevent the escape of gas into the interior space M of the annular tank (which is filled with air), and thus to effectually prevent the formation of an explosive mixture of gas and air. It is also necessary that the water in which the pipe is immersed be in permanent communication with the main water-column filling the tank, in order to be absolutely certain of the gas-pipes being always fully immersed during the working of the holder.

The necessary transfer of the horizontal tractive forces which are exerted from the curved plates E and F of the neighbouring bays on the parts of the elements of construction limiting the extensions X, is effected on the inner wall and at the bottom, by horizontal flat irons Q or T riveted at the ends.

In order to reduce to a minimum the weight of the water necessary for cutting off the gas from the accessible inner compartment M, a freely-suspended flat or slightly arched metal roof or cover N is arranged, which is brought as near to the water-level of the tank as practical considerations render admissible. By this means, it is possible to reach any part of the cover N from underneath, and to tighten or pack the joints. This metal roof or cover is constructed and suspended as follows: The plates of the roof or cover are first held in such way, by advantageously radially placed girders O to which they are connected, that these girders, which are changeable in the direction of the centre, are located at distances from each other which are not greater than is admissible for the normal strain of the plates by the weight of water and by their own weight. Seeing the total weight coming on the unit of surface of the cover is almost everywhere the same, it is advantageous to suspend the cover or its girders in a framework, which is made in the form of a spherical calotte or other rotary surface, and allows of an almost uniform utilization of the material. The cover-frame, which projects into the holder, and which is connected with the cover by hangers V, is made so as to be secured against rupture by meridional ribs P, ring strips S, and diagonal stays U lying in the rotary surface.

This framework of the cover serves at the same time for supporting the dome of the gasholder when in its lowest position, and for supporting the crown in case it is weighted by any foreign bodies. The framework, with the outer edge of the flat metal cover, is supported in the upper binding-ring D at the upper end of the inner pillars B (figs. 1 and 4).

The meridional pressure of the roof framework is counteracted in its vertical components by the wall-pillars B of the inner wall; while the radial and outwardly directed horizontal components subject the binding-ring D to annular tension, and thus advantageously relieve the binding-ring subjected to compression strains by the water pressure against the inner wall.

Comparative calculations and worked-out constructional drawings have shown that the present invention, says the patentee, owing to the advantageous utilization of all the metal parts, admits of an essential reduction of the weight of large tanks compared with constructions hitherto usual.

The weight carried by the supports of the present annular tank is so slight, that it can be in the form of single narrow pillars W (as in figs. 1, 3, and 7). By connecting the feet of these pillars, or by reversed arching between the pillars, the weight can be transferred to a continuous annular foundation of piles or concrete in such way that the specific weight on the ground is extremely slight; and, on this account, the cost of the foundations for such tanks, as against the usual arrangements, is reduced materially.

INCANDESCENT GAS-LIGHT FOR PHOTOGRAPHY.

The "British Journal of Photography" for the 1st inst. contains an editorial note on the above subject. The writer begins by pointing out that the photographer is perhaps more directly interested in the question of artificial illumination than most persons, inasmuch as he may be so circumstanced that the taking of portraits at night is a necessity of his business, or he may be situated in some manufacturing town where the atmosphere renders daylight of most uncertain quality, and therefore he must perforce adopt something more reliable. He is consequently called upon to solve the problem of what that "something" is to be. The article then proceeds as follows:—

> Of course, the electric light is to be "the light of the future"—that has been settled long ago; but it is quite certain that, as long as it costs about three times as much as its equivalent in gas, it cannot be recognized as the light of the present. And although the purse of the photographer may be deep enough to go to the expense of setting up an electrical installation, the mains have possibly not yet arrived at his street, and he must therefore, for the present, put electricity out of court. Acetylene, for some reason or other, does not seem to make headway in this country, although it is largely employed abroad. We have seen grand examples of its powers at various exhibitions, and a few years ago a special exhibit was made of it at the Albert Hall; but it does not get into common use. One may walk down all the chief thoroughfares in most of our large towns and cities and look for it in vain. It is very different with the incandescent gas-mantle, which is not only in evidence in every street, but has found its way to remote villages. Its light is most brilliant, the mantles have a far longer life than used to be the case, and they are cheap. Good mantles are now purchasable in London retail at 4½d. each; and in Germany, according to a speaker at the recent British Association meeting at Glasgow, they cost only 2½d. each. On the whole, therefore, and in view of the fact that it has been adopted so largely, we may look upon the incandescent gas system as being the most practicable of all recently invented methods of artificial illumination. There is another point in its favour which will tell in the near future, and which will probably lead it into keen rivalry with the electrical glow lamp. A non-illuminating gas will serve quite as well to make the mantle incandescent as will the gas now used in our houses. It is stated, on good authority, that such a gas can be produced and sold at a profit at about one-fifth the price of the ordinary product of the gas-works. We may therefore look forward to the time when this cheap gas only will be made, and when mantles will replace every other kind of burner.

Utilization of Waste Products.—At the opening meeting of the 28th session of the Liverpool Engineering Society last Wednesday, the President (Mr. A. Musker) devoted his Inaugural Address to a review of the progress made in the utilization of waste and bye-products in manufactures and the refuse of towns. He pointed out that a remarkable feature of the industrial development of the last century was seen in the multiplication of devices whereby such waste might be diminished, and every one of Nature's commodities turned to the best account. In the course of his address, he instanced sawdust, which seemed to the uninitiated to be quite useless, as a material which was employed in many ways. Subjected to various manufacturing processes, it yielded oxalic acid, tar, charcoal, and even gas. Coal dust, too—another apparently useless product—was formed into briquettes. In the manufacture of coal gas, the cost of the product was diminished by the recovery of the valuable bye-products, such as tar and ammonia. It would take too long to estimate what dyeing owed to coal tar. The carbon formed in gas-retorts was mere refuse; but it had been found that it was most suitable material for anodes in the electrolytic cell, and it was now sold at a price of several pounds a ton for this purpose. Town refuse even was now a valuable asset in conjunction with the destructor and the power plant; and it could be turned to account for the generation of electricity. The President gave numerous other examples of the way in which, what were supposed to be waste and refuse products were utilized during recent years, and made a source of profit in modern industry.

EARLY PLANT FOR MAKING WATER GAS.

Those of our readers who have turned their attention to the history of water-gas manufacture, as told in the interesting lectures and papers of Professor Vivian B Lewes, or as recorded in the contributions on the subject which have appeared from time to time in our columns, will remember that, though it is only within the last twenty years that the production of the gas on a commercial scale has been seriously undertaken in this country, the fact that it could be produced has been known to the scientific world for more than five times that number. It was the outcome of some of the valuable researches which, as Professor Lewes has pointed out, marked the latter half of the eighteenth century—a period which was so rich in scientific discovery. After the great investigations in connection with the synthesis of water undertaken by Cavendish, Monge, Laplace, and Lavoisier, and after the analysis of water had been effected in 1783 by the last-named distinguished chemist in conjunction with Meunier, Fontana demonstrated that water could be decomposed in its passage over red-hot carbon. But the first practical application of the discovery—the first attempt to utilize the products of this decomposition for lighting purposes—should, it appears, be attributed to Philippe Gengembre, a retired Inspector-General of Coinage in France, and his son Antoine, an architect, who early last century (in 1819) constructed an apparatus for producing illuminating gas composed of a mixture of water gas and oil gas, the latter being employed as an enricher. It is shown in the accompanying illustrations; fig. 1 being a plan, and fig. 2 a sectional elevation.

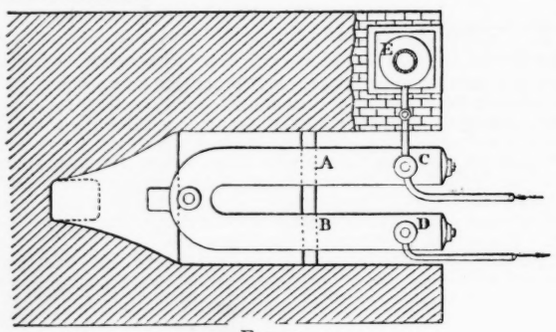


FIG. 1.

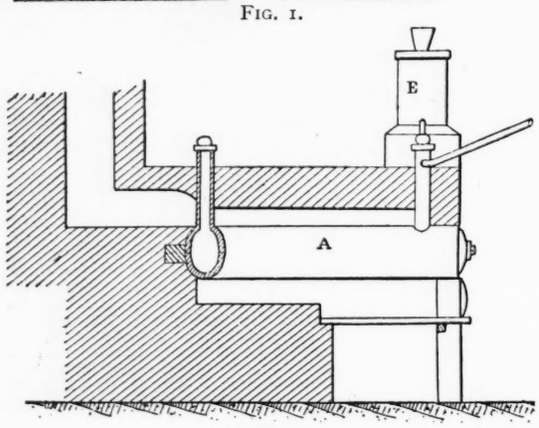


FIG. 2.

A cast-iron U-shaped retort A B was fitted up in a furnace and charged with charcoal. When this became incandescent, there was injected, by means of the pipe C, a jet of steam produced in an adjacent boiler; and at the point where the decomposition of the steam took place, oil from the vessel E was allowed to fall in drops. The gas generated passed on to the condenser by the pipe D.

This arrangement anticipated by some few years those of Vere and Crave (1823), Ibbetson (1824), and Donovan (1830), who are generally credited with being the introducers of water gas. Ibbetson's apparatus is shown in section in fig. 3. It was composed of a furnace containing a distillation chamber, the two sides of which enclosed an oven with reversed flame—that is to say, the flame descended through the fuel, and in so doing heated the outer surface of the distillation chamber, in which was placed the coal to be carbonized. As soon as this became converted into incandescent coke, a jet of steam was turned on to it. The discovery of water gas is also claimed by M. Jobard, of Liège, who in 1833 took out, in association with Selligue, a patent for decomposing water by means of red-hot carbon contained in cast-iron tubes placed vertically in a furnace. A small stream of water flowed continuously over the carbon in the first tube and was decomposed, liberating much hydrogen and carbonic acid. The whole passed into the second tube, where it was reduced to a mixture of carbonic oxide and hydrogen, which reached the third tube simultaneously with a stream of schist oil falling upon incandescent iron chains. This process was similar to that which Donovan had devised three years previously in Dublin. Professor Lewes says that when Ibbetson's process came to be tried, it was found that the temperature of the carbonaceous matter was too low, and that "the large quantities of carbon dioxide produced utterly ruined the illuminating power of the coal gas." This led to its failure; and a similar fate attended Donovan's efforts. The system of MM. Jobard and Selligue was tried at Belleville, as well as at the Batignolles (Paris) and at Dijon. Most of the installations of these inventors were tested, with the co-operation of M. Grouvelle, who lighted the Mazas Prison by one of the systems.

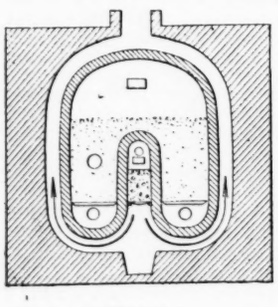


FIG. 3.

The subject of the production of water gas was studied by Lowe (1831), Leprince (1844), Murdoch and Pollard (1845), and Gillard (1846). The process of the last named investigator consisted, according to Professor Lewes, in employing a sort of cupola furnace, and "raising the temperature of the carbonaceous fuel by blasting it with air instead of heating it in a retort fired from without." In fact, he it was who introduced the "blow-and-run" system which has become so general in connection with the manufacture of water gas. Gillard's process, which was put into practical operation at Narbonne in 1856, was capable, it was claimed, of generating 350,000 cubic feet of gas in 24 hours. It had been previously tried at Passy, near Paris, and at Palma. He made, particularly, hydrogen gas, consumed by means of special burners surmounted by a small basket of platinum thread, which, being raised to a white heat by the combustion of the hydrogen, yielded an absolutely steady and very brilliant light. This was the *début* of incandescent gas lighting. The process having been unsuccessful at Narbonne, it was replaced by a system suggested by the Galy-Cazalet apparatus, which, dispensing with distillation chambers or continuously heated retorts, enclosed in a cupola a mass of coke which was brought to a state of incandescence by its own combustion. As soon as the requisite degree of heat was reached, the draught and the communications with the outer air were shut off, and the steam was turned on and decomposed.

Later investigators into the subject of the production of water gas were White (1847-9), Barlow, Gore, and Kirkham (1852), Jacquelain (1854), Fayes and Sanders (1859), and several others; but their inquiries did not lead to any definite results. It was not until Tessié du Motay took up the matter that carburetted water gas was manufactured on a really practical scale. His

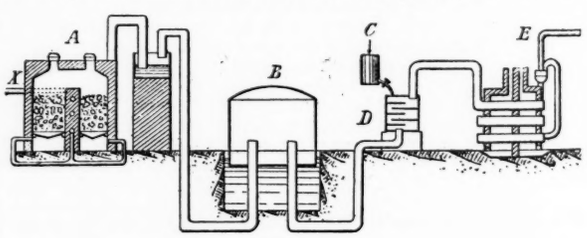


FIG. 4.

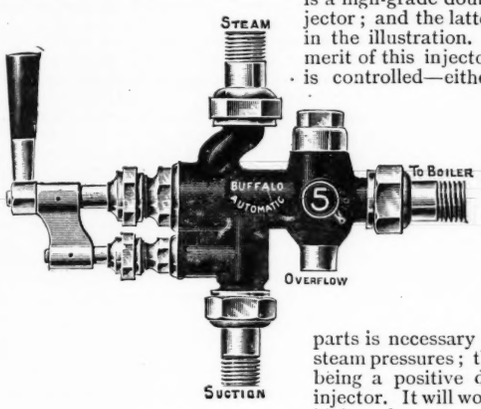
apparatus is shown in fig. 4, in which A is the generator, B the gasholder, C the naphtha oil vessel, D the carburettor, and E the gasifier. Steam was introduced from an adjacent boiler by the pipe X. The gas when produced passed to the purifier by the pipe rising from the right-hand side of the gasifier. As Tessié du Motay found there was no possibility of getting his invention worked in France, he took it to America, where between the years 1875 and 1877 his primitive appliances were perfected by Strong and Lowe. With their work and that of their successors, readers of the "JOURNAL" are familiar.

This short reference to the early efforts in the direction of manufacturing water gas must not be closed without due acknowledgment that most of the particulars given, and the illustrations accompanying them, have been taken from an article entitled "Le Gaz à l'Eau Carburé," by M. Laverchère, in recent issues of "Le Génie Civil."

A "First-Aid" Lamp-Post.—The "Daily Graphic" last Tuesday contained an illustration of the new *phare de secours*, or "first-aid lighthouse," which is now being put up in the streets of Paris. It consists of an ornamental bronze pillar about 15 feet high, with a round overhanging top resembling that of a lighthouse, and containing a clock-face barometer and three transparent pictorial advertisements revolved by clockwork and lighted by gas from within. In the base of the pillar is a letter-box, and in the shaft is a folding stretcher with printed directions for affording first aid to the injured. In case of a street accident, the stretcher can be immediately obtained by breaking a small glass window just above the letter-box, taking out the key, and unlocking the receptacle.

A BOILER-FEED INJECTOR.

Important though the boiler-house is on a gas-works, one hears very little about it and its equipment outside; and when gas engineers visit the works of their fellows, the boiler-house, as a rule, receives slight attention. There may be a walk through it, and a remark as to the type or types of the boilers, but very frequently nothing more; and yet there are several interesting features about them which might be worth a little study. A new list of the engineering specialities of Messrs. Green and Boulding, of Bunhill Row, E.C., suggests, for example, one point, and that is the feeding of the boiler. The long experience of this firm should have enabled them to determine the essentials of an efficient and economical boiler-feeder; and the success which they have evidently achieved with their "Buffalo" injector (more than 21,000, we are told, are in use) is a pretty good indication that they have solved the requirements. As the instrument is made to-day, it embraces their best knowledge. The injector is manufactured in two classes, designated "A" and "B." The former is a high-grade double-tube injector; and the latter is shown in the illustration. The chief merit of this injector is that it is controlled—either stopped or started—by one single lever; and therefore it cannot be misunderstood. No regulation of cones or other parts is necessary for varying steam pressures; the machine being a positive double-tube injector. It will work on either high or low steam pressures, takes hot or cold water, feeds through economizers or feed-water heaters, and generally (to sum up) does the work of the usual feed-pump at much less initial outlay, and the cost of maintenance is infinitesimal as compared with the pump. Further considerations are that it occupies trifling space, and can be taken from its connections in a few minutes with an ordinary spanner. Another important point—and this applies to both classes of the injector—is that they work either lifting or with overhead supply; and they do not need adjustment or attention when used under either condition. The quantity of water delivered can also be graded; thus enabling a larger injector to be fitted (than required by the evaporation of the boiler), and keeping a margin of reserve power in hand. Although a cheaper machine, injector "B" has also the advantage of a single lever to stop or start—a feature unknown in other cheap injectors. Both classes, we are informed, are largely in use for feeding steam-boilers in many public lighting stations and leading gas-works.



PREPARATION OF PRUSSIAN BLUE.

A recent number of the "Revue des Produits Chimiques" contained a description of the method of preparing prussian blue by the direct utilization of cyanogenated mud, practised by the German Continental Gas Company. The mud is composed essentially of a double insoluble salt of ferrocyanide of ammonium, with a small quantity of iron sulphide, a solution of sulphate of ammonia, carbonate of ammonia, and sulphide of ammonium. To extract prussian blue, the following process is employed: The double salt is isolated, and transformed, by the aid of alkalies or alkaline earth, into a soluble ferrocyanide salt, which, under the action of salt of ferric oxide, added with or without ammonia, gives prussian blue. If instead of that salt a ferrous oxide salt is employed, prussian white is first obtained, and then transformed into blue by oxidation. The new preparation is based upon the observation that prussian white, transformed by oxidation into prussian blue, already exists in the mud, and that all that is necessary for recovering it is to remove the ammoniacal compounds with the iron sulphide which may still exist. To extract these substances, the mud is heated for a considerable time, and then the volatile compounds are disengaged. After heating, the mud consists of prussian white and a solution of sulphate of ammonia, which is separated by pressure, after rendering soluble, by the addition of sulphuric acid, the iron sulphide which may be present. Heating may be dispensed with by immediately adding condensed sulphuric acid to the mud until neutralization is effected. In the treatment, the volatile ammoniacal compounds are transformed into sulphate of ammonia, with liberation of sulphuretted hydrogen and carbonic acid; so that after isolation of the insoluble cyanogenated compounds, known as prussian white, there remains a condensed solution of sulphate of ammonia. The eliminated prussian white is then oxidized by the usual method, and transformed into the prussian blue of commerce.

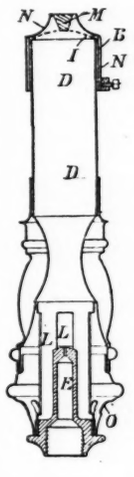
REGISTER OF PATENTS.

Construction of Gasholders.—Lake, H. H.; a communication from O. Intze, of Aix-la-Chapelle. No. 23,513; Dec. 22, 1900.

This invention refers to annular tanks for gasholders of sheet metal, characterized by the tank being constituted of single elements which are composed of vertical outer and inner wall pillars, joined at their lower ends by a cross-piece, and at their upper ends by outer and inner binding-rings, and the vertical spaces between which are closed by bent or bulged plates—all as fully described in p. 1246 of the current number of the "JOURNAL."

Incandescence Gas-Burners.—Trocquenet, C. L. J., of Paris. No. 12,956; June 25, 1901.

This invention consists chiefly in the employment of a mixing-tube for incandescence gas-burners having a contracted portion of variable diameter, according to the delivery of the burner to which it is applied.



The burner is constructed of a metal casing, to the lower part of which is fitted the ejector E, at the centre of which the gas enters through an aperture of conical shape. This ejector is screwed into a cylinder (provided with lateral openings L), which can slide vertically in the base of the casing, which has at its lower part holes O serving for the admission of air. Through the upper portion of the casing passes a tube D for receiving the removable head or burner proper. At its middle part, this contracted tube assumes the form of a double truncated cone; the cones being joined at their smallest end so as to contract the passage for the mixture of air and gas.

The removable head or burner proper is placed at the top of the tube D. It consists of a cap B provided with a wire gauze top I, on the centre of which is a cone M serving to diffuse the gas at its outlet. Over this cap is passed a second cap N, having an aperture at the top which forms, with the cone M, an annular space where the gas is ignited. The two caps B and N are secured to the tube D by a pressure screw.

The gas enters through the ejector E, and is forced towards the lower base of the double truncated cone formed by the contraction of the tube D. The outer air enters through the holes O and L; and the mixture enters the tube D after having been compressed, and at a higher rate of speed, by reason of the contraction of the tube. It there expands and reaches the head or burner proper, the wire gauze I of which it passes through, and is then burned. This burning takes place at the upper annular aperture formed by the top of the cap N and the cone M carried by the wire gauze I. The position of the lower tube carrying the ejector can be varied vertically, so as to bring its upper opening nearer to, or farther from, the base of the double truncated cone. The contraction of the tube D—that is to say, the relation of the bases of the truncated cones—varies according to the quantity of gas delivered, and according to the power of the burner employed.

Treatment of Sulphuretted Hydrogen and other Bye-Products from Alkali and other Works.—Wilton, G., of Beckton. No. 15,468; July 30, 1901.

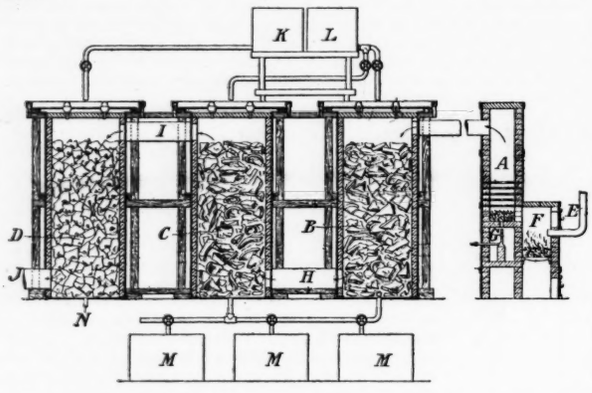
This invention has reference to the treatment or utilization of sulphuretted hydrogen and other bye-products from alkali and other works—particularly applicable for employment in the manufacture of sulphate of ammonia. One object aimed at is to provide an economical process or method of treating the sulphuretted hydrogen, whereby it "may be economically and thoroughly absorbed, and either discharged from the plant in an innocuous condition, or (according to the preferred modification of the invention) utilized to produce a valuable bye-product—namely, sulphate of iron." A further object is to utilize the sulphuretted hydrogen evolved in the manufacture of sulphate of ammonia to improve lime-containing waste-liquors—such as the waste liquors from sulphate of ammonia plant—and to transform such waste liquor into a practically inoffensive effluent.

The patentee proposes to burn the sulphuretted hydrogen in a suitable furnace, whereby it is transformed into sulphurous acid gas, and cause this gas to react as hereafter described, in order to produce the particular results desired.

The treatment of the sulphuretted hydrogen to produce sulphate of iron consists in leading the sulphuretted hydrogen through a furnace, preferably admitting an excess of oxygen to the furnace for the purpose explained later. The resulting sulphurous acid gas is then to be brought into intimate contact in suitable chambers with iron or iron compounds, preferably in the form of iron scrap. The sulphurous acid gas—which is admitted to the towers, where it comes in contact with water supplied thereto, or it may be the mother liquor from the sulphate of iron crystallizing tanks as hereafter mentioned, or both water and mother liquor—in passing through the iron scrap reacts therewith to form sulphite of iron; and the excess oxygen present in the gas transforms the sulphite to sulphate. This salt, being soluble, is taken into solution, and passes away with the water or mother liquor into suitable vessels, where the sulphate of iron may be crystallized out. As the sulphurous acid gas admitted to the towers is very hot, it has a concentrating effect on the sulphate solution therein.

The illustration (p. 1250) of the plant (in elevation, partly sectional) is given to show the construction of the sulphuretted hydrogen furnace and the packing of the towers. A is the sulphuretted hydrogen furnace; B and C, the towers packed with iron scrap; and D, a similar tower packed with limestone. These towers may be built as wooden framings lined with lead. The furnace A (preferably vertical, as represented) is built of brick; and the sulphuretted hydrogen is led by the pipe E into a chamber F over fire-bars upon which hot coke is placed. There are also slides or dampers by which it is possible to regulate the air

admission to the plant for the purpose of burning the sulphuretted hydrogen, and producing sulphate of iron. G is a gas-flame near the current of gas to be consumed, to assure combustion thereof, with a layer of refractory material above it through which the gas is caused to pass with the object of dividing up the gas. Baffles are interposed in the uptake of the furnace, to cause the gas to take a sinuous course.



The current of sulphurous acid gas produced in the furnace A passes through the connecting-pipe to the top of the first tower B, which is packed with iron scrap. This tower is constructed of a lead casing lined with acid-resisting brick. There is a dished luted distributing cover for the tower, which serves to distribute the liquid with which the towers are fed. Lutes are provided in the cover, to prevent any escape of gas from the tower. The current of gas, after passing down through the tower B, goes by the connecting-pipe H to the base of the tower C, which is constructed and fitted in a similar way to B. The gases pass up this tower, and by the pipe I to the tower D, of similar construction to the two previous towers, but filled with limestone. Any gases remaining after passing through this last tower issue at J; being preferably drawn away by a chimney-shaft. K L are tanks mounted on staging above the towers, to contain the liquid to be distributed thereto.

In the present case, the liquid in the tank L is assumed to be water or mother liquor; and that in the tank K the waste liquor from the sulphate of ammonia plant. The latter tank is shown as discharging by pipes on to the tower D; while the other tank discharges on to the towers B and C. M are sulphate of iron crystallizing tanks, in which the liquor issuing from the towers B and C is received, and from which it may be pumped into a suitable tank (L, for example), when it is desired to utilize it again in the towers B and C. N is the liquor-outlet for the tower D. It preferably discharges the liquor into cooling chambers before it is allowed to pass to the drains or elsewhere.

The operation of the apparatus is as follows: The sulphuretted hydrogen coming from the saturators of the sulphate plant passes by the pipe E through the furnace A, as described; and the resulting sulphurous acid gas, with the excess oxygen admitted by the dampers, passes to the towers B and C, where reaction takes place with the iron scrap; sulphate of iron being produced (as described) and dissolved by the water or liquor from the tank L—the resulting liquor passing to the crystallizing tanks M. The remaining gas goes on to the tower D, passing through the limestone packing—meeting a current of the waste liquor from the tank K. The sulphurous acid gas is thus neutralized by the limestone and by the alkalinity contained in the waste liquor; soluble salts being formed, which are taken into solution, and pass away at N as a practically inoffensive effluent. The last traces of sulphurous acid are absorbed by the waste liquor fed to the tower; the carbon dioxide and steam, which practically constitute the final discharge, passing away to a chimney-shaft or the like. Thus a constant current of gas is maintained through the plant; and the sulphuretted hydrogen is economically and efficiently disposed of. At the same time, it is utilized to obtain a valuable product—sulphate of iron—and to greatly improve the condition of the final effluent discharged into the drains or elsewhere.

Driving Mechanism for Conveyors, Elevators, &c.—Jenkins, W. J., of Retford. No. 17,272; Aug. 28, 1901.

In this driving mechanism for conveyors, elevators, or hoists, two strands of chain or rope are employed in combination with the conveyor chain wheels or pulleys, of a differential gear, which automatically adjusts the relative driving positions of the wheels on the driving-shaft, in such a manner that inequalities in the lengths of the two chains, resulting from unequal wear or unequal stretching, are compensated for, and the driving force applied to each strand of the chains is rendered approximately equal.

Gas-Lamp Lighting Devices.—Boult, A. J.; a communication from P. Bardot, of Lyons. No. 17,936; Sept. 7, 1901.

This invention relates to street-lamps provided with one or more incandescent burners and an auxiliary (emergency) burner, adapted to be put into action in the event of the breakage of the incandescent mantles. The lighting of the lamp may be effected, without opening it, from the exterior by means of a double cock, one plug of which effects: (1) The lighting of the perforated auxiliary tube-burner, for transmitting the flame to the main burner; (2) the continuous supply of gas to the main burner, and the extinguishing of the auxiliary burner; and (3) the extinguishing of the main burner, while the other plug is destined for the supply only of an auxiliary emergency burner, when the mantle of the main burner has become broken or deteriorated—the supply to the latter burner being cut off.

Fig. 1 shows the lamp before lighting; and fig. 2, the same when being lit.

The lamp (as indicated) can be entirely closed in with the exception of the necessary air-passages. It is provided with an incandescent burner B, with an auxiliary lighting-tube C, and an auxiliary emergency burner D—both supplied by a double cock E, to which the gas is led in the direction of the arrow. The plugs of the cocks are actuated by levers.

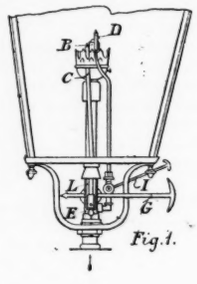


Fig. 1.

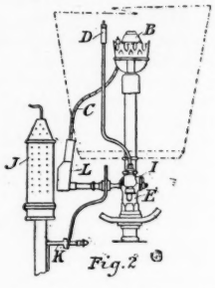


Fig. 2.

For lighting the burner B, the lever G is turned from the position shown in fig. 1 into the vertical position by means of a rod, provided at its top with a lamp or torch J (fig. 2), and carrying a hook K. By this the torch is brought next to the opening of a sheath, which screens an injector; and the auxiliary tube C, becoming ignited, transmits its flame to the burner. After the burner has been lighted, the light of the auxiliary tube C (being no longer required) is extinguished on the continued turning of the plug into the horizontal position. Here the main gas-burner B only is fed with gas; the lighting having been effected in a fraction of a minute, during the half revolution of the lever G, and without a perceptible stop in the intermediate position.

Assuming, now, that the mantle has become deteriorated, and gives no light, the auxiliary emergency burner D may be set in action in the following manner. The lever I is turned in the position shown in fig. 1, by which the plug of the burner D is opened. Then the lever G is turned into the position shown in fig. 1, which is the initial position of the lever, and corresponds with the closed position of the incandescent burner. On turning the lever G into the position shown, a short stoppage must be made in the vertical position, in order to permit the tube C to be lighted. The tube C and the incandescent burner are thus both out of action, and the emergency burner only is at work.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Method of Charging Inclined Retorts.

SIR,—Many gas managers have asked me what bearing Mr. Shoubridge's statement: "I once accepted an assurance from Mr. Little"—*vide* p. 1108 of the "JOURNAL" for Oct. 29—had on the question of the best method of charging inclined retorts. I could not enlighten them, as I had never supplied any machinery for Salford or the Crystal Palace Gas-Works. I, therefore, wrote to Mr. Shoubridge, requesting him to explain; and the following is his reply:—

Lower Sydenham, S.E.,
Nov. 4, 1901.

Sir,—In reply to your letter of the 2nd inst., the assurance referred to in my letter to the "GAS JOURNAL" is that you gave me with regard to the assistance you would give to the Corporation of Salford at the trial of the action against them for infringement of the Coze patent.—Yours truly,

Mr. G. Little. SYDNEY Y. SHOUBRIDGE.

What on earth, I wonder, has the Salford infringement of Coze's patent to do with the cost of constructing the ironwork for inclined retorts, or the appliances for charging. If Mr. Shoubridge still feels sore over his defeat, it is surely on Lord Justice Romer and Mr. Fletcher Moulton, K.C., M.P., who made it clear Coze had a good patent, that he should vent his spleen. It is a pity an engineer of Mr. Shoubridge's undoubted ability should let himself get angry, and indulge in meaningless statements having no bearing whatever on the point at issue, because other engineers with a wide knowledge of the cost, and great experience in the methods, of charging, decline to admit his contentions and claims (in the same way, and with far more apparent reason, as he declined to recognize the improvements of Coze—the unrewarded introducer of successful inclined retorts).

I, for one, decline to admit that centralized hoppers and loaded traversing chargers are the immortality-conferring attainments of automatic carbonizing; and I have shown that the continuous hopper is the cheaper and more automatic method. Coze's idea of setting retorts about the angle of repose was the Alpha of success for inclined retorts; the Shoubridge shoot is far from being the Omega; and we can surely get at bottom-facts, as Mr. Herring indicates, without any exhibitions of ill-nature, or the introduction of irrelevant remarks, on the part of any contributor to the important question of the best method of constructing and charging "slopers."

Smethwick, Nov. 8, 1901. GILBERT LITTLE.

The Dellwik and Strache Water-Gas Systems.

SIR,—I have seen the notice you gave on Oct. 29 (p. 1108) from the Société International du Gaz d'Eau, of Brussels, the owners of the Strache water-gas patents, concerning my article on water gas in "The Mineral Industry."

It is unnecessary to say that all my publications are open to public

criticism, as far as facts are concerned. But I have a right to object to my critics imputing to me other motives than those prompted by my own knowledge and conviction. This objectionable course is taken by the Strache Société, in suggesting that my statement concerning the advantage of employing cheap fuel for water gas (the fairness of which they cannot impugn) has brought out the advantageous features of their process, *without wishing to do so*.

This unfair suggestion has not a shred of truth, as anybody can see who reads my paper. When I collected, about eighteen months ago, the materials for my article, I was informed from a reliable source that the Strache producers did not work without a substantial admixture of coke to the coal used; and I have up to now no reason to doubt that the statement was perfectly correct when made.

G. LUNGE.

Zurich, Nov. 4, 1901.

The Retorts at the Granton Gas-Works.

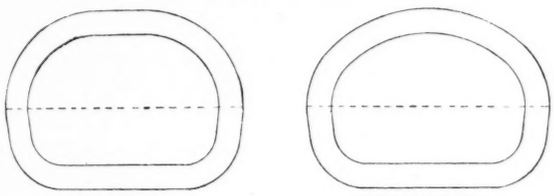
SIR,—I have no intention of entering into a controversy with Mr. Herring on the subject of inclined retorts. I am quite aware that I cannot convert him, and equally sure that he cannot convert me.

There is, however, one portion of his article (to which you direct attention) that I must notice—viz., that where he accuses me of copying his section of retort without acknowledgment; for that is what he infers, although he does not, as you point out, specifically claim the design as his own. He says merely: "the section which I have had working in Edinburgh since 1898." Probably he does not know who designed it.

There is a little mistake in the statement just quoted; for Mr. Herring told the Scottish Society of Arts that the retorts in question were not worked until the autumn of 1899 (see "JOURNAL," April 3, 1900, p. 866), or nearly nine months after, and that is an important difference, as will be seen later.

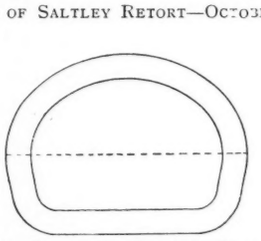
Mr. Herring claims to have made this section of retort known for the first time on May 1, 1900; and again, with an illustration, in July, 1900. This is quite correct; but it is also true that I made a design of a retort of almost this shape for the Birmingham Corporation Gas-Works at Nechells, and sent it to Mr. Hack on Oct. 28, 1898. Mr. Hack modified the design slightly, and approved it on Oct. 31, and all the retorts for the Nechells works were ordered in November of that year—*i.e.*, more than five months before Mr. Herring first spoke on the subject.

The section as modified by Mr. Hack is precisely similar to that subsequently adopted by Mr. Herring. It is clear, therefore, that I did not copy Mr. Herring. But it is not equally clear that he did not copy me; for my drawing was sent to a number of retort makers, to tender from, quite soon enough for him to have seen it before the retorts were made for the setting he erected in 1899.



Original Design. Modified Design.

SECTION OF SALTLEY RETORT—OCTOBER, 1898.



SECTION OF EDINBURGH RETORT—MAY 1, 1900.

If he did not adopt my design, it is certainly remarkable that his section should be exactly similar, as you will see it is from the enclosed sketch.

SYDNEY Y. SHOUBRIDGE.

Lower Sydenham, Nov. 9, 1901.

Inclines v. Horizontal Retorts.

SIR,—It would be well, in trying to compare the advantages of carbonizing in large gas-works by inclines against horizontal retorts with machinery, if some definite line were adopted so as to arrive at the actual advantages of each system. In all works, local conditions play so important a part that it is difficult to make actual comparisons.

To go no further than Mr. Herring's own works. It would be absurd to compare (say) the horizontal retorts and machine stoking at the New Street works, with all their inconvenient surroundings and make-shift arrangements, with the inclines at Granton, where everything has been arranged from the start of the works, and no expense spared to give the inclined-retort system every advantage.

It seems to me that the comparison must be restricted to the actual carbonizing cost—viz., the charging of the coals into the retorts and the drawing out of the coke. Coal-breaking and conveying plant can be used identically for the two systems; so also can any arrangement for dealing with the coke after it leaves the retorts. If money is saved by any of these accessories, the credit should be given where it is due, and not to the system of retorts used. The heating arrangements and cost thereof should also be left out, as whatever methods are adopted for this purpose, can be equally applied to either system.

The real basis of comparison for cost should, in my opinion, be: Capital charges for coal hoppers, charging and drawing appliances, retort-bench with all fittings above the floor level, and other capital charges required by one system and not needful for the other, wear and tear of everything connected with the drawing and charging, and cost of labour for drawing and charging only.

In addition to comparisons of actual cost, other considerations will no doubt be weighed by engineers, such as: The comfort of the men while at work; the facility for altering the amount of the charges to suit the temperatures of the retorts, and the class of coals being used; the placing of the coal in the retorts with certainty, so as to give the best results; being able to use any class of coal without restriction.

Many other considerations might be stated; but sufficient has been said to show that any comparison that may be made between the two systems must bear on the precise points of difference.

Many of the apparently low figures quoted either on the one side or the other, have little bearing on the point at issue, as no details are given as to what these costs include.

SCOT.

Nov. 8, 1901.

Income-Tax Assessment.

SIR,—After reading the remarks made by the Chairman at the recent annual meeting of the Gas Companies' Protection Association, and in view of the correspondence in the "JOURNAL" lately, I thought the following might be of further interest in connection therewith.

Our annual assessment for income-tax payable on profits of trade for the four years previous to last year (1900) averaged in round figures £2700; but when the notice of assessment arrived for the year above mentioned, we found an increase of over £400, in face of the fact that our actual profit for the year was below the average. Inquiry from the Surveyor of Taxes elicited the information that he had graciously increased our assessment to this amount, owing to our stocks on hand at Dec. 31 last being of increased value to that amount, more than at the same date twelve months previously—a most interesting and original proceeding on his part, I should think.

However, when I had the pleasure of explaining to the Commissioners that this was the first occasion in our history that such an increase had been made on this head, and that the cause of the variable difference in the value of stocks was practically accounted for by the high price at which coal had to be purchased last year, they did not take long to decide that ours was a very just appeal, and struck out the offending amount, which they could hardly help doing, when shown that the total amount of the assessment was so disproportionate to previous years.

This I think plainly shows to what lengths some of our respected Tax Surveyors are prepared to go, and the truth of what Mr. Livesey said at the meeting previously referred to—that "it did not do to agree to everything that these people claimed."

I should imagine that this case of ours will be hard to beat; and in relating it I hope it will put others on their guard against such proceedings. They also should not on any account value their stocks at current rates, but on the lowest possible basis.

MIDLANDS.

Nov. 9, 1901.

The Water Supply of Santos, Brazil.

SIR,—Many of your readers will be benefited by the information contained in Mr. H. K. Heyland's letter in the "JOURNAL" for Oct. 29 (p. 1108). This Company appears to be quite up to date in its management, and in the selection of the Venturi meter for the measurement of the output of water from the reservoirs, a lengthy discussion on which was concluded in the "JOURNAL" for Dec. 26, 1899 (p. 1556), one quotation from which may be useful.

It cannot be too often repeated that it is a fallacy to assert that such a quantity of water has been pumped, when the amount is ascertained only by computing the quantity of water delivered, by multiplying the capacity of the pump-barrels by the number of strokes, and deducting a percentage therefrom for slip; no consideration being taken whether the engine is running slowly or at the normal speed. Such records will be found to be very inaccurate when compared with the automatic diagram taken from the Venturi measuring tube.

This meter gives a self-recording diagram of the hourly rate of consumption, as well as the daily consumption. It also gives the waste line by night, and is a perfect diagrammatic record of all that takes place during the twenty-four hours. Much has been written as to the supply of water by measure—see "JOURNAL" for Oct. 9 and 23, 1888; Dec. 31, 1889; and April 2, 1899—but the opinions of water engineers are undergoing great changes, and the use of meters is being extended very rapidly. Your contemporary the "Engineer" states that the proper or suitable meter has not yet been made; but the Santos Company have evidently found one that will answer their requirements, and by fixing a large number of these positive meters, the consumption has been reduced to a minimum.

This change of opinion among water engineers, as indicated by the Santos Company, who have procured the right to meter every service, and to charge the consumer for any excess beyond a stipulated maximum quantity, at a minimum price, is also indicated in the discussions of the British Association of Water-Works Engineers, and the advance in the use of meters for all "mixed" services, the automatic flushing "monstrosity," and all trade purposes (we scarcely ever hear now of unmetered trade supplies). Although the movement is slow among water engineers of Britain, it is sure ere long to become the universal method of rating, checking, and preventing waste of water.

While thanking Mr. Heyland for the valuable information given of another town supplied by meter, we should be glad to know the waste-line maintained on the Venturi diagram; and seeing that considerably over one-third of the services are measured through positive meters, what is the domestic consumption per head per day? And if another third of the services were metered, what further reduction would be expected from the change? The transition from rating the water by measure is progressing rapidly; and any information on the subject will be esteemed by many readers of the "JOURNAL," as well as by

METER SUPERINTENDENT.

Nov. 7, 1901.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, Nov. 11.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* STIRLING *and* MATHEW.)

Welsbach Incandescent Gas-Light Company, Limited, v. General Incandescent Company, Limited—Same v. Barnard.

These were two appeals by the plaintiff Company—the first against an order made by Mr. Justice Joyce, the Vacation Judge, on the 27th of August, and the second against a similar order by the Lord Chief Justice, on the 8th of October, in each case refusing an injunction.

Mr. BOUSFIELD, K.C., and Mr. WALTER appeared for the plaintiff Company, the appellants; Mr. ASTBURY, K.C., and Mr. NEILL represented the respondents.

Mr. BOUSFIELD said these two cases might practically be dealt with together, and there was a third one, lower down in the list, which was also very similar; and he thought that their Lordships might kill three birds with one stone. The main appeal raised a question as to the principle on which interlocutory injunctions ought to be granted; for in this particular instance it affected so many cases that it really was in the nature of a principle. The patent in question was one of 1893, relating to a mantle composed of thorium with a very little cerium. Practically, all mantles now used for incandescent lighting were made on this patent—thorium with 1 or 2 per cent. of cerium; this being the only mixture which at present had given first-rate practical commercial results. The original patent had expired; and this one was in the nature of an improvement. This was an appeal against a refusal by the Judge in Chambers to grant an interim injunction on this patent against an infringer. His submission was that injunctions ought to be granted in all these cases, unless there were special circumstances, such as *laches*, which would disentitle the plaintiffs to such relief. The patent had never been the subject of a "full-dress rehearsal" in Court—that was to say, it had never been fought out to a finish. There was a case in which it was anticipated that it would be fought; but, when it came into Court last March, defendant did not appear. Mr. Justice Channell heard the plaintiffs' evidence, considered it, and granted a certificate of validity,* which, of course, primarily was only for the purpose of costs in subsequent actions. The learned Counsel then proceeded to give a history of the Welsbach litigation against the United Chemical Works on the "Guaranty" mantle, where an injunction was refused; but this was, he said, before Mr. Justice Channell had given the certificate of validity. Mr. Justice Farwell refused an interim injunction in the Long Vacation of 1900; and, instead of appealing against that, the plaintiffs, after the vacation, issued another writ against the same people in respect of the same infringement. The matter came before Mr. Justice Day, who granted an interim injunction, which was brought before the Court of Appeal, when it was discharged†. [The learned Counsel read the judgment of the Court of Appeal in this case.] The next was the case against the "Standard," which was before Mr. Justice Farwell in December, 1900; and there again an injunction was refused—an early day for the trial being granted. Letters of Request to Foreign Courts to examine witnesses were obtained, which had led to delay; and the consequence was that all the actions were hung up indefinitely. This was an extremely profitable thing; and most of the defendants were small people who, in the meantime, made considerable profit out of selling these mantles. The action which came before Mr. Justice Channell was against one Krumm, who did not appear; and it had been said that his Lordship had granted the certificate with reluctance. The learned Judge, however, when the observation was made to him in Chambers, said it was not at all true. This was recognized as putting a different complexion on the patent; and since then some hundreds of injunctions had been granted.

Mr. ASTBURY said that in these cases the injunction was not disputed, except in one case against the Intensified Company.

Mr. BOUSFIELD said an injunction was granted by Mr. Justice Day in April last against the Vulcan Company, which came to the Court of Appeal; and he would read the judgments of their Lordships refusing to interfere with the discretion of the learned Judge who granted the injunction. The next case was one against the Export Company, in which an injunction was granted by Mr. Justice Day; and the Court of Appeal confirmed his order.‡ The next case was that against the Intensified Company, which was in respect of a "Guaranty" mantle made by the United Chemical Works, against whom the plaintiffs had failed to get an injunction. This came on in July before Mr. Justice Lawrance in Chambers, who granted an injunction. On the appeal, Mr. Astbury appearing for the appellant, he argued the case for about two hours on Bank Holiday; and then a point was discovered, which had been overlooked—that these people were not entitled to challenge the validity of the patent, and therefore the appeal failed, though the real question was not decided. There was another case in which Mr. Justice Lawrance granted an injunction against the Bolton Corporation, which was confirmed. The position hitherto taken up by the Court was that the certificate of validity was only *primâ facie* evidence; but that the Court ought to act upon it in the absence of special circumstances. This was his contention, which would apply to all three appeals now in the paper. The plaintiffs were in very great difficulty. The manufacture of these infringing mantles was very simple and cheap; anybody with a few shillings' worth of apparatus could do it. Former servants of the Company might easily start in a back room, as had been done; and not only in this country but abroad were these mantles made, and the country flooded with them. The plaintiffs had got hundreds of injunctions; but they detected perhaps only one case out of five. They had to employ a whole lawyer's staff in following up these people; and if there was a delay of three months, it was said there had been *laches*. It was unquestionable that the mantle in question was the plaintiffs' invention; but the Company were unable to pay a dividend owing to these repeated infringements. Their agents could not sell mantles at 6½d. or 7d., when the country was flooded with mantles at 2d. and 3d. each. There was an action which ought to have come on for trial last April against the United Chemical Works; and it would have been tried but for the Letters of Request, which had caused great delay.

Lord Justice MATHEW asked to what point these letters were directed.

Mr. BOUSFIELD said it was asserted that Dr. Auer von Welsbach, before the date of the patent, had invented this in Germany, and sent over stuff in bottles which the Welsbach Company used, and sold mantles made from it before the date of the patent. There was an action with the Sunlight Company which was settled; but in that action a Commission did go out to obtain evidence.

Lord Justice STIRLING asked if the present defendants were manufacturers or purchasers.

Mr. ASTBURY replied that they were very large manufacturers in this country.

Mr. BOUSFIELD said he was told they were two former servants of the plaintiffs.

Mr. ASTBURY denied that this was so.

Mr. BOUSFIELD said it was a Company with a total capital of £1000. In the present case, he did not suppose the action would ever come to trial

Lord Justice MATHEW asked if there were other defendants who were substantial people.

Mr. BOUSFIELD said there were defendants who were substantial, who they believed intended to contest the matter.

Lord Justice MATHEW said the Court could not act on the suggestion that this particular action would never come to trial, as a reason for the interference of the Court. There ought to be a test action; and the parties now before the Court should agree to abide the result.

Mr. BOUSFIELD said the difficulty was that no action could come on for trial for many months; and the question was what ought to be done in the meantime.

Lord Justice MATHEW said the Court must protect the plaintiffs as far as possible, but not by attempting to ascertain whether or not the patent was valid. What did the learned Counsel suggest?

Mr. BOUSFIELD replied that he suggested that the Court should grant an injunction.

Lord Justice MATHEW remarked that this was determining the question.

Mr. BOUSFIELD said his submission was that the Court should act upon what was laid down in the case of the Vulcan Company.

Lord Justice MATHEW asked if anything less would satisfy the plaintiffs. He should have thought they might have protected themselves in some other way.

Mr. BOUSFIELD said no other protection was possible. There were hundreds of these cases, nearly all by small people. He submitted that, the certificate of validity having been given, this was *primâ facie* evidence; and in the absence of special circumstances, the Court should grant interim injunctions.

The MASTER OF THE ROLLS said unfortunately there was a case of validity to be tried, and Letters of Request had been obtained. The plaintiff Company were *dominus litis*.

Mr. BOUSFIELD said the plaintiffs could not push the matter forward any faster. The old rule was that, when a patent was about seven years old, the Court took this as *primâ facie* evidence of validity.

Lord Justice STIRLING remarked that in this case the patent was amended in 1899.

Mr. BOUSFIELD said no one looking at the amendment could say that it made the patent any less likely to be valid.

Lord Justice MATHEW asked why it was made.

Mr. BOUSFIELD: It was made *ex abundante cauteli*. It simply struck out three of five things, so as to limit the claim to cerium and uranium.

Lord Justice STIRLING remarked that they might have to omit two more before they got the right thing.

Mr. BOUSFIELD said that did not alter the presumption as to validity. These other things were practically of no use in competition with cerium. Thorium and cerium were the only compounds practically of any use. If he had advised, he should probably have said: "Strike out all except cerium." In reply to a further question, he said the earliest order for Letters of Request was in April. Evidence had been obtained abroad in another action which was settled—an action against the Sunlight Company, in which similar questions were raised.

Lord Justice MATHEW suggested that it would be a reasonable condition to impose at Chambers that the opponents should accept what had been already obtained by these Letters of Request.

Mr. BOUSFIELD said if the defendants liked to go to trial immediately, and take all the depositions which were taken in the Sunlight case, the plaintiffs were perfectly ready to do so.

Lord Justice MATHEW said this seemed a proper course to take.

Mr. WALTER followed, and submitted that this was a question of the balance of convenience. The plaintiff Company were prevented from paying a dividend by reason of these persistent infringements; and he said the circumstances surrounding this litigation were absolutely different from anything which had ever arisen before.

After some discussion between the learned Counsel and Mr. Neill as to what happened in Mr. Justice Farwell's Court in the Standard case with regard to the Letters of Request,

Mr. WALTER said the plaintiff Company had every reason to believe that Krumm's case would be fought. The defendant was acting for two German manufacturers whom they could not get at. The mantles were not even delivered in this country, but f.o.b. at Hamburg or Antwerp; and men of straw in England were put up to defend until the last moment, when they did not appear. There was no doubt the plaintiffs were the owners of this patent. They had made the business in this country, and had introduced incandescent lighting. They had a certificate of validity, and yet they could not pay any dividend because of the millions of infringing mantles.

* See "JOURNAL," Vol. LXXVII., p. 690. † *Ibid.*, Vol., LXXVI., p. 1279.
‡ *Ibid.*, Vol. LXXVII., pp. 1394, 1676.

Lord Justice MATHEW: We have nothing to do with that.

Mr. ASTBURY said that, when their Lordships heard the real facts, he thought they would have little doubt that the judgment was right. There was only one case which had really been litigated in which an interlocutory injunction had been granted, and that depended upon exceptional circumstances. An interlocutory injunction was granted against the Intensified Company; and in that case the defendants had taken a licence from the plaintiffs in which there was a provision that they should not be at liberty to contest the validity of the patent either during or after the continuance of the licence. The moment that this was discovered, of course they could not escape the injunction. The only other three cases which had really been fought were the Vulcan, the Export, and the Bolton In the Vulcan case, the matter went off because the appealing Company had been ordered to be wound up, and the Court were of opinion that a Company in liquidation was not entitled to present an appeal. In the Export case, no evidence was filed by the defendants, either of invalidity or non-infringement; and therefore there was nothing for the Court to try. In the Bolton case, no adverse order was made, because the Welsbach Company offered, on the suggestion of the Court, that until the hearing they should supply the defendants with as many mantles as they desired. That was the history of the only case in which the Welsbach Company had had any success. In every other disputed case, they had been defeated on this question of interlocutory injunction. Mr. Bousfield had said they had no opportunity of testing this patent and establishing their rights; but a remark of that kind was hopeless. There was a case against the Sunlight Company; but rather than try it the Welsbach Company bought up the whole of the defendant Company's assets for £110,000. It was in that case that evidence was obtained on Letters of Request.

Mr. BOUSFIELD said there was a petition to revoke the Kern burner patent, an action for infringement of the Kern patent, an action by the Welsbach Company against the Sunlight Company on the 1893 patent, and by the Sunlight Company against the Welsbach Company on an earlier patent. There were seven heavy actions, and litigation had been going on for about seven years; and the Companies arrived at the conclusion that the simplest way was to end all these disputes by buying up the Sunlight concern. The suggestion that the Welsbach Company were avoiding the trial of this patent was quite unfounded. There was evidence obtained on those very Letters of Request.

Mr. ASTBURY said a great deal was made about these letters; but their Lordships had not been told that the only reason for their issue was that the Welsbach Company had refused in these cases to answer interrogatories as to what was being done by them in the years 1891, 1892, and 1893. It was entirely their own doing.

Lord Justice MATHEW: The evidence you want has already been obtained.

Mr. ASTBURY said the Court had been told so, but that was not accurate.

Lord Justice MATHEW: On the assumption that it has been, you have nothing to say. You had better direct our attention to the point as to whether there is anything further you say can be obtained by Letters of Request. Speaking for myself, if I thought you were making a difficulty about this part of the case, I should be very much influenced in dealing with this application.

Mr. ASTBURY said it was put against him, first, that the Letters of Request issued in the Sunlight case had obtained the evidence that he wanted; but this was not so. Secondly, it was said that the Letters of Request were asked for to delay the trial; and this was not so. In the Sunlight case, over which the present defendants had no control, the Letters of Request were issued to examine Dr. Welsbach in Vienna. In the cases now pending, which he personally knew something about, they had discovered a great deal of additional evidence, and had Letters of Request addressed to people in Berlin as well; and they were hoping to get totally different, and very much wider, evidence than was obtained in the Sunlight case—evidence to prove what the plaintiff Company had been doing in England in the years 1891 and 1892 by way of public sale.

Lord Justice MATHEW asked why they went to Vienna.

Mr. ASTBURY said because the people who sent the stuff over to England were there. It was made in Vienna and Berlin. They could not ascertain the facts here, because the plaintiff Company refused to answer interrogatories. The case was reported in the "18th Patent Reports." Counsel then narrated the circumstances with reference to the refusal of the Welsbach Company to answer interrogatories; saying that if they had done so the Letters of Request would have been unnecessary. In the Sunlight case, the letters were only addressed to Vienna. A great deal had been made of Krumm's action. But Krumm was a costermonger, who really did nothing but put in a defence. He never appeared; and his defence did not raise this question of prior user. He simply denied infringement of the prior patents of 1885 and 1886, and pleaded anticipation of the 1893 patent.

The MASTER OF THE ROLLS asked if the plaintiffs were prepared to answer the questions they had successfully avoided answering.

Mr. WALTER said the Board of the Welsbach Company were not the Board of the Incandescent Company. They were totally different Directors.

Lord Justice STIRLING: Are all the officers different?

Mr. WALTER: Some are different.

Lord Justice STIRLING: But you have an officer who can tell us what has been going on?

Mr. WALTER: I do not know, my Lord.

The MASTER OF THE ROLLS asked how the Welsbach Company obtained a decision in their favour.

Mr. WALTER said they contended that the onus of proof was on the other side; and they offered that any of these gentlemen might be subpœnaed as witnesses.

The MASTER OF THE ROLLS said the reply put in was that they were not bound to answer facts within their knowledge which they had acquired in another capacity. This was based on the hypothesis that some of them had the knowledge, but were not bound to answer the questions which it was desired to put. He asked if the plaintiff Company were prepared now to answer the questions by the gentlemen who knew the facts.

Mr. WALTER said the defendants might call any of these gentlemen as witnesses.

Lord Justice MATHEW: Oh, no; that is quite a different thing.

Mr. WALTER said the Court of Appeal had decided that they had sufficiently answered the interrogatories, and they did not propose to answer further. Let the defendants prove their case.

Mr. ASTBURY said the gentlemen who knew the facts were Mr. De Fonblanque, the former Secretary, who was a Director of the present Company, Mr. Moeller, the old Managing Director, who still held office, and Mr. MacKean, the Chemist.

Lord Justice MATHEW said there was no doubt the information could be got, as was conceded on the application to the Court; but it was said there was no right to demand it.

The MASTER OF THE ROLLS said they need not trouble Mr. Astbury any further. This was a question for discretion, under all the circumstances; and the learned Judge at Chambers had exercised that discretion by refusing the injunction. The Court had invited the Counsel for the plaintiffs to assent to what appeared to be a very reasonable term. They had been asked whether they were prepared, here and now, to give the information which they successfully evaded giving on a technical point—a good point—in the Court of Appeal. But having refused to give the information, the result had been that the other parties had been forced to apply for Letters of Request. This necessarily led to long delay; and now the plaintiffs came and set up as their main ground for insisting on the injunction, that the delay would be so long by reason of the Letters of Request that the defendants ought to be restrained in the meantime. It turned out that there was good ground for saying that this delay was really brought about by the plaintiffs relying on a point which they were entitled to rely upon, but one which, if they did rely upon it, involved delay. Under these circumstances, having a discretion in such a matter, it seemed to him that the justice of the case would be met by affirming the decision of the learned Judge who refused to grant an injunction. Of course, the defendants must be put upon the terms of keeping an account.

Mr. ASTBURY said this had been done already.

Some further discussion ensued, as the result of which it was made clear that both of the above appeals were dismissed, and that the present appellants should be bound by the decision in the action against the United Chemical Works, providing there was a contest. The costs of the appeals would be costs in the respective actions.

Welsbach Incandescent Gas-Light Company, Limited, v. Blackburn Incandescent Gaslight Company.

In this case (Mr. Walter admitting, in answer to the Court, that he could not distinguish it from the two former cases), the appeal was allowed on the same terms; the learned Judge having in that case granted an injunction.

The Right to Use a Well.

In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Kekewich had before him the case of *Attorney-General v. Tonkin*. It was an action brought at the relation of the West Penwith Rural District Council against the Rev. John Tonkin and the Anglo-Bavarian Brewery, Limited, whose registered office is at Shepton Mallet, Somerset. The plaintiffs' case was for a declaration that, under section 64 of the Public Health Act, 1875, the well known as the King's Arms well, in the parish of St. Buryan, in the County of Cornwall, was vested in and under their control, for the purpose and within the meaning of the Act. They also claimed an injunction to restrain the defendants from blocking up, obstructing, or in any way interfering with the well, or any pump or other apparatus used, or to be used, for pumping water from it, and from doing any act, matter, or thing whereby the inhabitants of the parish would be prevented from enjoying free and unrestricted access to the well, and from freely taking water therefrom. They likewise claimed damages for the wrongful removal of a pump set up by them. Mr. P. Ogden Lawrence, K.C., and Mr. T. T. Methold appeared for the plaintiffs; Mr. Warrington, K.C., and Mr. Cave represented the defendants. Mr. Lawrence said the only question to be determined by the Court was whether the Public Health Act vested the property in question in the Council at all, and whether there had been such a user of the well as to make it a public one. Evidence having been given, Mr. Warrington admitted that if the well was a public one within the meaning of the Public Health Act, it was vested in the plaintiffs. His Lordship reserved judgment, which he gave on Thursday. Having dealt in much detail with the points raised, he came to the conclusion that the plaintiffs had failed; and he therefore dismissed the case, with costs.

Nuisance from an Electric Light Works.

In the Chancery Division of the High Court of Justice, on Thursday last, Mr. Justice Kekewich had down for hearing an action brought by Mr. Wrigley, a well-known resident in the Lake District, to restrain by injunction the Windermere and District Electricity Supply Company, Limited, from conducting their business in such a manner as to cause a nuisance to the plaintiff, whose house was in the vicinity, by smoke, noise, and vibration. The case had been before the Court on various occasions; and a gentleman was agreed upon to visit the place, and to make a report for the guidance of the Court. This gentleman had reported that there was a nuisance caused by noise; and the action was ordered to stand over with the view of seeing what remedy could be provided. Mr. Lawrence said that the defendants were spending a great deal of money in order to get rid of the noise, and were adapting their works to modern requirements. He asked his Lordship to assist the parties by suggesting that the experts should meet with the view of seeing what could be done in the matter. After a conference, an order was agreed to admitting that the plaintiff was entitled to an injunction to restrain the Company from carrying on the works so as to occasion nuisance, and continuing an undertaking given on July 30, with liberty to the plaintiff to apply at any time, after the expiration of six months from this order, for an injunction.

Conviction for Stealing Gas.

At the County of London Sessions, last Friday, before Mr. Loveland Loveland, K.C., the Deputy-Chairman, Henry Valentine Mendelssohn Hill was indicted for having stolen 500 cubic feet of gas, the property of the Gaslight and Coke Company. Mr. TraversHumphreys and Mr. Boyd appeared to prosecute; Mr. Lever defended. The proceedings before the Magistrate were reported in the "JOURNAL" on the 15th and 22nd ult. (pp. 979, 1041). The accused was a hairdresser and tobacconist in the Wandsworth Bridge Road. On the 1st ult., a gas-fitter in the service of the Company visited his shop, and found that there was a small pipe connecting the pipes in the house with the main, so that gas was consumed without passing through the meter. Mr. Humphreys said the thefts must have been going on for some time, as it was found that each quarter the prisoner's gas bill was far less than half the amount charged for gas consumed in similar businesses with the same number of lights. The prisoner was sentenced to four months' imprisonment in the second division.

Compensation for the Death of a Son.

At the Greenwich County Court recently, Agnes Buckingham, of Dillwyn Road, Lower Sydenham, claimed from the Crystal Palace District Gas Company £300 as compensation on the death of her son by her first marriage, Thomas Boyd Maquire, upon whose earnings she was dependent. Deceased, who was fatally injured while following his occupation as a shunter, earned an average of 30s. a week. The Judge awarded £211 8s. compensation. The decision may possibly be the subject of appeal.

A Bankrupt Gas-Mantle Inventor.

A short time ago, the first meeting of the creditors was held, before Mr. C. A. Pope, the Assistant-Receiver, under a receiving order made against Mr. Gerhard Bodo Puchmüller, a general engineer, described as of Rosslyn Hill, Hampstead. Prior to 1897 the debtor resided in Germany, where he was interested in the invention and manufacture of a new mantle for incandescent gas lighting. Owing to the difficulty of obtaining patents in Germany, he came to England, and in February, 1898, formed the Daylight Incandescent Mantle Company, with a capital of £100,000. As vendor, he received £80,000 in shares, of which £40,000 went to the promoters and £28,000 to various persons for commissions, &c. He filled the position of Managing-Director for six months; and he attributed his failure to litigation which ensued with the Welsbach Company, in consequence of which he had to part with his shares at a great sacrifice. The accounts had not been filed; but the liabilities were roughly estimated at £5300, against assets of unascertained value. In the absence of a quorum of creditors, the meeting was adjourned for a fortnight. The accounts were submitted at a subsequent meeting, when it was ascertained that there were no available assets.

Alleged Slander by a Resident Gas Engineer.

The action by Mr. Alexander Forbes, jun., one of the Contractors for the construction of the new gas-works at Granton, Edinburgh, against Mr. H. H. Gracie, the Resident Engineer on the works, which had been raised before Lord Kincairney in the Court of Session (*ante*, p. 1041), has been settled. The pursuer sued for £1000 as damages for alleged slander, said to consist of remarks made to a policeman, which meant that Forbes had been guilty of the theft of the handles of a crane. The action has been settled by a payment of 25 guineas and expenses, and an apology in which the defender withdraws the expressions (if any) used by him concerning the pursuer, which could be construed as a charge of theft against him, there being no ground therefor, and expresses his regret for the occurrence. The action was defended by the Gas Commissioners, who have wisely thought it better to compromise a case which does not bind them in any way in the future, rather than to incur the expense of going to trial over what occurred in a dispute between one of their officials and a Contractor with whom there is no permanent cause of quarrel.

Deficient Illuminating Power at Faversham.

At the Faversham Petty Sessions last Wednesday, the Gas Company were summoned by the Corporation for supplying, on Oct. 14, gas of less illuminating power than they were bound to supply by their Act. It appeared that the Company were compelled to supply gas equal to 15-candle power; whereas a test taken by Mr. W. J. Dibdin on the date in question, showed that the gas then supplied was only equal to 12·3-candle power—a deficiency in quality of nearly 25 per cent. The Corporation, it was stated, had been complaining to the Company for the past eighteen months of the inferior light, but to no effect. The Company, whose defence was the disorganization of their works, owing to extensions, were fined half the full penalty—viz., £10 and costs. In imposing the penalty, the Magistrates acquitted the Directors of intention to defraud.

West's Gas Improvement Company, Limited, have in hand contracts for installing their compressed air stoking machinery and coke-conveying machinery at the two large gas-works of the Copenhagen Municipality. The contracts include all the necessary coal-handling machinery and coke conveyors for conveying the coke from the front of the retort-benches to the yard. They have also in course of execution contracts for complete installations of their compressed air stoking machinery, with the necessary coal-handling plant, for the Sunderland Gas Company, the Croydon Commercial Gas and Coke Company, and the Tynemouth Gas Company. During the past twelve months, they have installed compressed air stoking machinery at the Beckton works of the Gaslight and Coke Company; also at the Greenock, Nottingham, Southport, Halifax, Walsall, and Oldham Corporation Gas-Works. Several of these installations are already in operation, and others will be put to work at an early date.

MISCELLANEOUS NEWS.

NEW GAS-WORKS SCHEME FOR BIRMINGHAM.

A Proposed New Site and Further Parliamentary Powers.

The Annual Meeting of the Birmingham City Council last Saturday contained a double event for the Gas Department. In the first place, the Chairman of the Gas Committee, Mr. J. H. Lloyd, had conferred upon him the honour and dignity of the Lord Mayoralty of the city. The new Lord Mayor is the third member of the Lloyd family who has served the city as its Chief Magistrate; and his father, who was Mayor in 1870, is still one of its Aldermen. The new Lord Mayor was also unanimously elected to a vacancy on the aldermanic list. Regarding the second event, the Gas Committee submitted a report of an importance which will arouse more than ordinary interest in the gas world. In brief, they are proposing, notwithstanding the enormous extensions at Nechells and the improvements at Saltley, to acquire an entirely new site for additional gas-works, and to proceed to Parliament for extended powers, among which is the raising of a further capital sum of £500,000.

In the report, the Committee state that for some years they have given careful consideration to the acquirement of additional land for gas-works purposes. In February, 1898, an exhaustive report was presented to the Council detailing the growth of the department since the Corporation purchased the undertaking in 1875; and a chart was then submitted showing an estimate of the probable consumption each year up to 1901-2, based on a calculation of an increased consumption of 4½ per cent. compound, which showed that, whereas the output of the Gas Department was nearly 2000 million cubic feet in 1876, it was estimated that in 1901-2 the consumption would reach a total of 5900 million cubic feet. That the estimate was approximately correct is borne out by the fact that in the year ended March, 1901, the consumption of gas amounted to no less than 5,709,610,700 cubic feet. Dividing it into periods, the increased consumption has been as follows: 1876 to 1881, an average of 5¼ per cent. compound per annum; 1881 to 1886, 5 per cent.; 1886 to 1892, 4¼ per cent.; 1892 to 1897, 3⅜ per cent.; 1897 to 1901, 4 per cent. Only in one year—1893-4—out of the entire period has the quantity of gas consumed shown any decrease on that of the preceding year. In 1899-1900 the increased output was 7·6 per cent.; and, having regard to the abnormal annual increase in the number of consumers of gas for household purposes under the prepayment meter system, and to the increasing demand that is continually being made for gas for power and heating purposes, the Committee are of opinion that it is necessary to make arrangements for a further output, on the assumption that the average annual increase will continue to be not less than 4½ per cent. compound during the ten years from 1902-3 to 1911-12.

The report presented by the Committee in February, 1898, and approved by the Council, authorized the reconstruction of the old retort-houses at Saltley and Windsor Street, the reconstruction of Adderley Street works, and the erection at Nechells of a retort-house and condensing plant, and on the Devon Street land of the additional purifiers and other plant required for the Nechells extensions, which it was anticipated would meet the future probable demand for gas to the winter of 1905-6. The Committee are now of opinion that it is urgently necessary to have regard to the probable demands that will be made upon the department beyond that period, and as it has been estimated that it will not take less than five years to erect plant to be available for the manufacture of gas at that date, their earnest attention has been given to acquire a suitable site for the establishment of new works. Sites have been viewed at Saltley, Plant's Brook, Walmley, Selly Oak, and Birches Green, Erdington. With respect to the last-named site, the Committee have received a letter from Mr. Hallewell Rogers in which he said: "With reference to the several sites for new works which the Works Sub-Committee visited on Oct. 17, and to the unanimous concurrence of the members of the Gas Committee, after full consideration of the matter, that the site at Birches Green was the most suitable for the purposes of the Gas Department, I have, through an agent, acquired the freehold, comprising 108 acres or thereabouts, for the sum of £15,500, and I now have the pleasure of offering to transfer my interest in the land at cost price to the Corporation." The land in question is bounded on the south by the Birmingham and Fazeley Canal, which separates it from the sewage farm. The main line of the Midland Railway Company between Birmingham and Derby is slightly less than half a mile from the nearest point to the land in question, and can be connected thereto across land belonging to the Drainage Board.

The price at which the land is offered to the Committee, including buildings thereon valued at £3000, is equivalent to £143 10s. 4d. per acre, or less than 7¼d. per square yard. There are ten cottages on the land, which now let at rentals aggregating £98 16s. per annum, and a portion of the land, about 96½ acres, is let at present on annual tenancies producing £245 per annum—a total immediate annual return on the whole site of £343 16s., or about 2½ per cent., and, in addition, there is the commodious family residence formerly occupied by the late Mr. J. W. Yates, with gardens and land attached thereto, containing about 11 acres. Including the length of branch line above mentioned, the site is nearly 2½ miles nearer to the coal-fields on the Midland Railway Company's system than the Saltley works, while the land is at a level that will secure an economical distribution of the gas produced At the present time, there is a very limited number of houses erected within 300 yards of the site in question; and consequently little opposition, if any, can be offered to the erection of gas-works thereon. The selection of a suitable site becomes more difficult and more costly each succeeding year, owing to the rapid growth of neighbourhoods adjacent to the city; and the Committee urge the Council to avail themselves of the favourable terms of purchase now offered. They therefore recommended that the land be purchased, and that the Town Clerk be instructed to have it conveyed to the Corporation.

As the opportunity has only just occurred to acquire a suitable site, and as it is necessary to obtain parliamentary sanction to the use of the

land for gas-works purposes, the Committee consider that it is absolutely necessary to secure its inclusion in the Bill now being promoted in Parliament. It is also considered advisable that the site of a public-house on the west side of the land should be scheduled for compulsory purchase, and also a strip of land on the east side, containing about 12 acres, extending to the road running from Birches Green Farm to Wood Lane Farm. The Committee therefore further recommend that, in making application to Parliament, powers be sought to schedule the whole of the land above mentioned—a total of 120 acres or thereabouts—for gas-works purposes, and to raise further capital not exceeding £500,000. Before commencing to erect works on the new site, the proposals of the Committee will be fully reported, and the sanction of the Council obtained thereto.

The hour was late on Saturday afternoon when the Lord Mayor, as Chairman of the Gas Committee, moved the adoption of the recommendation relating to the purchase of the 108 acres of land.

The LORD MAYOR remarked that the Gas Department had been in the hands of the Corporation for 25 years, and by the exercise of care the capital had only increased from £2,084,000 to £2,857,000, while the gas consumed had increased from 2000 million cubic feet to 5709 million cubic feet. The price of gas was 20 per cent. less. Four years ago the Engineers called the attention of the Committee to the necessity for making provision for further extensions that would become necessary. There had been a remarkably steady development of business—the increase being 4¼ per cent.—so that in eighteen years the output would be doubled. It might be said that this would be checked by the electric light; but that was not their experience so far. Taking the two wards most affected by electric light—Market Hall and Edgbaston—they found that in the first-named, in 1896 473 million cubic feet of gas were consumed, and by 1901 an increase of 40 million had taken place. In Edgbaston, 180 million cubic feet in 1896 had grown to 195 millions in 1901. Slot meters were becoming a great item in the work of the Gas Department. There were now above 14,000 in use—an increase of 160 in twelve months. As practically the whole of the land now available for gas-works would be utilized in four years' time, the Gas Committee thought it essential to purchase the land at Birches Green, which would be all they would require for 25 years at least. The land formed an excellent site. It was near the city; and the Council could get it at a reasonable price. They were indebted to Mr. Hallewell Rogers for negotiating the purchase of the land without letting it be known that the Corporation were in the field for it. An income of 2¾ per cent. was at present derivable from the property, so that the loss to the Corporation would be small until they were ready to use it.

Mr. WALTHALL protested against the matter being brought forward so late in the afternoon, and advised that it should be postponed to another day. He moved, as an amendment—"That having regard to the definite statement made to this Council by the Gas Committee in May, 1900, that the sum of £500,000 then authorized to be borrowed would meet the requirements of the next ten years, the present proposal be referred back for further consideration."

Alderman COOK considered that it would be worth while to have the discussion adjourned, even if it were necessary to have a special meeting. Personally he could not immediately vote for the recommendation.

Alderman BEALE proposed: "That the further consideration be deferred, and that in the meantime the Committee be authorized to give such parliamentary notice as would be required in the event of their proposal being confirmed."

The LORD MAYOR assured the Council that there was not the slightest desire to rush the matter through; and if the Committee could have seen their way not to bring it forward that afternoon, they would have postponed it. They felt, however, it was hardly fair to the Council, to themselves, or to Mr. Hallewell Rogers to allow delay.

Other members having expressed the opinion that it would not be wise to rush the matter through that afternoon, the Lord Mayor accepted a suggestion that the debate should be adjourned until to-day (Tuesday).

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. T. H. GOODWIN NEWTON in the chair.

The SECRETARY (Mr. R. W. Wilson) having read the notice convening the meeting,

The CHAIRMAN fixed the seal to the Register of Proprietors, remarking that the number continued to increase, which was evidence that more persons were wishful to join the membership of the Association.

The SECRETARY then read the following report for the half year ending June 30:—

The following summary shows the results of the Association's operations during that period: The quantity of gas made in the half year was 3925 million cubic feet. The quantity made in the corresponding half year of 1900 was 3534 million cubic feet—an increase of 391 millions; or at the rate of 11·10 per cent. The total number of lights on the 30th of June last was 2,526,797. At the close of the corresponding half year, the number of lights was 2,258,355—an increase of 268,442, or at the rate of 11·9 per cent. The number of consumers on the books at the close of the half year was 218,979—an increase in the past twelve months of 27,534, or at the rate of 14·38 per cent. During the half year, 36 miles of new mains were laid—making the total mileage of mains in use on the 30th of June last 1812.

During the half year under review, 2s. 8d. more per ton had to be paid for coal; but, owing to the higher value of the coke produced, the net cost of the coal was only 1s. 6d. more per ton than in the corresponding half year.

The revenue derived from the sale of tar and its products increased satisfactorily; but that obtained from the sale or treatment of ammoniacal liquor remained stationary.

Notwithstanding the increased cost of coal, the profit resulting from the workings at stations shows an increase; and this is chiefly due to the considerably larger sale of gas at nearly all the stations. On the other hand, the income derived from dividends on investments and interest was less than in the first half of 1900, due to the sale of securities in order to meet the capital expenditure entailed by the large extensions being carried out at Berlin and other stations.

The plant and mains at all the stations were maintained in a due state of efficiency.

At Aix-la-Chapelle, the erection of the purifiers, transferred from the Erdberg works at Vienna, was completed. In the place of the late Mr. Janssen, the Directors have appointed as their legal representative Mr. Dubusc—a gentleman of position in this town.

At Antwerp, the erection of the water-gas plant was completed ready for trial. Some economy was effected in the cost of this plant by utilizing one of the gasholders from the old Esplanade works there, which, as the proprietors are aware, were thrown out of use some years ago, and are now entirely dismantled. The new 35 ft. by 30 ft. purifiers at Berchem were also completed.

At Berlin, satisfactory progress was made with the new works at Mariendorf, and the first complete section was so far advanced at the end of the half year as to ensure its being ready in time to cope with the demands of the approaching winter.

At Berlin, both the Municipality and the Association charged differential maximum prices for gas—viz., 16 pfennigs per cubic metre for gas sold for lighting, and 10 pfennigs per cubic metre for gas sold for heating, cooking, and industrial purposes. Influenced by a strongly supported movement for a reduction in the price of gas, the Municipality recently took the question into serious consideration, and finally resolved upon the adoption of one uniform maximum price—viz., 13 pfennigs per cubic metre. The Association necessarily followed suit; and, by virtue of a special agreement between the Municipality and the Association, the new price came into force on the 1st of April last. As the consumption of gas for cooking, heating, and industrial purposes at the price of 10 pfennigs per cubic metre had of recent years grown with remarkable rapidity, and at the close of 1900 represented about 40 per cent. of the total sales of gas, it might have been anticipated that the introduction of a uniform price of 13 pfennigs would adversely affect the consumption of gas; but this has not been the case. The number of consumers on the books, and the sale of gas, far from suffering any decrease, continue to grow in a satisfactory manner.

The Association's contract with the commune of Steglitz, near Berlin, was prolonged by five years until 1926. A contract was also concluded with the commune of Stahnsdorf—to the south-west of Berlin—until 1952. The Directors were able to complete the acquisition of the shares and business of the Oberspree Gas Company, which supplies a number of communes to the east of Berlin. The supply of gas from this Company's works only dates from the 4th of February, 1899, but is rapidly increasing.

At Brussels, the new purifiers at the Forest works were completed. Good progress was made with the erection of a four-lift gasholder of a million cubic feet capacity, in a steel tank, at the Koekelberg works. The laying of electric cables in Etterbeek and environs was continued; and the supply of current from the new station at Woluwe was commenced in March last. The Association's contract for the supply of gas to Essonnes from its works at Corbeil was prolonged to the year 1941.

At Flushing, the erection of a new purifier-house was completed, to which will be transferred four 13 feet square purifiers taken from the Esplanade works at Antwerp.

At the Bockenheim works, at Frankfort-on-Main, arrangements were made for the erection of four 38 ft. by 32 ft. purifiers from the Erdberg works at Vienna.

At Hanover, a contract was concluded with the commune of Badenstedt until 1925.

At Komotau, the Directors availed themselves of an opportunity to enlarge the site of the gas-works by the acquisition of a neighbouring piece of land. The construction of an electric station on the site of the gas-works was completed; and the supply of current commenced.

At Lille, a new building was erected on the Vauban works, to contain larger and improved plant for the treatment of ammoniacal liquor.

At Saaz, one of the stations in Bohemia recently acquired by the Association, the price of gas was reduced, and a satisfactory increase in the consumption has resulted therefrom. Considerable extensions to the system of mains there are in progress.

At Vienna, the taking up of the mains in the inner districts of the city was actively proceeded with; and on the 30th of June last, two-thirds of the entire length of the system had been taken up. The dismantling of the works no longer in use was continued, and a considerable quantity of plant of various descriptions was transferred to other stations of the Association, as has been mentioned above, where additions to the works are required to meet the growing demand for gas.

The rapidly growing importance of the Floridsdorf works near Vienna rendered their connection with the railway very desirable; and arrangements have now been made for the construction of a siding on to the works.

Land for which the Association had no further use was disposed of on advantageous terms at Haarlem, Toulouse, and Vienna.

The Directors regret to report the death, after a brief illness, of their Chief Engineer at Antwerp, Mr. John Frederick Drory, who had been a devoted servant of the Association for the long period of 42 years. The vacancy thus created has been filled by the transfer from Haarlem to Antwerp of Mr. W. J. Brender à Brandis.

Mention has been made in a former report of the transfer of the Essegg and Neutra stations to a new Hungarian Company styled the Central Gas and Electricity Company. Since then, the Directors—feeling assured that there is a considerable future in Hungary—have increased their interest in the said Company, and now hold three-fourths of the total share capital.

The Directors desire, in conclusion, to draw the attention of the proprietors to the accounts for the half year ended the 30th of June last. These have been duly audited, and, from them, the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme, showing the profit of the Association for the half year and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 5 per cent. for the half year ended the 30th of June last, payable, free of income-tax, on and after Tuesday, the 12th inst.

The CHAIRMAN said, before moving the adoption of the report, or even saying one word of comment upon it, he must congratulate the proprietors, and he did so most heartily, upon its highly encouraging character. Turning to the summary of the results, the proprietors would have observed that to get a comparison with the corresponding half year, they had not on this occasion to exclude any first-class station from the calculation, as had been the case since the first half year of 1898, but which, so far as he could foresee, would not be the case again for many a half year to come; and what was more to the point, however, and more satisfactory, was that the gas consumed to-day was almost equal to the gas consumed before the cesser of Amsterdam and Vienna. Compared with the corresponding half of last year, the increase in the quantity of gas made and in the number of lights, was again at the rate of 11 per cent., and formed, as far as it went, some reliable index of the progress of the Association. The rate of increase in the number of consumers—14 per cent.—could not fairly be relied upon as an index of great progress; for it included

the prepayment meter consumers, who, in the majority of cases, were but small consumers individually. The cost of coal, it would be observed, had risen, though this was partly compensated for by a better price for residuals. The Board were able to report that, at the end of the half year under review, the first section of the new works at Mariendorf was sufficiently advanced to ensure it being ready in time to cope with the demands of the approaching winter. He had the pleasure of informing the proprietors that, with one of his colleagues (Mr. R. Tindall), he had the honour about a fortnight since of charging the first retort in that section; and the Directors heard that the section was already practically making its output felt throughout the wide area supplied by the connected works by means of which the Association supplied Berlin and its suburbs. Perhaps he could not give a better illustration of the progress made at Berlin since the days when the Association appeared there as the pioneers of gas supply, than to mention that five days' output of the section in question would have met the demand, both public and private, for fifteen months 76 years ago. He might remark, in passing, that the English equivalent of 10 pfennig per cubic metre of gas was (say) 3s. per 1000 cubic feet. At Haarlem, where the contract expired in December, 1902, and where the Municipality, after that date, would supply gas, the Board had, since the close of the half year (in fact, within the last two months), made an arrangement under which the authorities acquired the whole of the distributing plant on reasonable terms. The works, which were not of a modern description, would be dismantled, and the land, where freehold, sold. In the increased price of coal was included the tax of 1s. per ton imposed by Parliament on coal exported from the United Kingdom. The quantity exported by the Association since the commencement of the year amounted to nearly 200,000 tons; but he was pleased to tell the proprietors that the Directors had recently been officially informed that the contracts current at the date of the imposition of the tax had been exempted from the duty, and that the sums they had paid would, in due time, be refunded to the Association. Some had already been refunded; and consequently the present half year would benefit to that extent. He might supplement what was mentioned in the report with reference to Vienna, by stating that, within the last few days, arrangements had been made by Dr. Teltscher for the sale, on acceptable terms, of the Association's offices on the Burgring, which were no longer central to their area of supply in Vienna. Perhaps some present might be asking how it was that the investments showed a decrease, and would like to know where the money had gone to. He did not see any reason why their natural curiosity should not be gratified; and he was happy to give the proprietors what he thought was a satisfactory explanation. The principal item of expenditure had been at Berlin, in the first finished section of the new works at Mariendorf, to which he had referred. The site for these works, the proprietors would remember he had informed them, had an area of nearly 200 acres, and cost alone £100,000. This section was estimated to cost £279,000, of which about £240,000 had been expended up to the first of last month. To give the proprietors an indication of the capital demands for Berlin, he might say that they had already commenced building a second gasholder tank, and next year they must in all probability begin the second section of the works. A word of commendation should be said here for their Resident Engineer, Mr. Ed. Drory, and his assistants, who had so efficiently carried out these works under the watchful eye of their Consulting Engineer (Mr. Corbet Woodall). Brussels, Antwerp, and Frankfort, in the order named, had also very materially contributed to the general increase of business, and had therefore required a large outlay to enable them to keep pace with the demand for gas. During the three years up to Dec. 31 next, the outlay for capital purposes would have reached the enormous sum of 1¼ millions sterling; and, as he said before, this large amount was taken out of investments (where it yielded a small rate of interest), and applied to its legitimate purposes, where, if not at first, he had no doubt in due time it would earn a manufacturing profit. The proprietors might well imagine what care and anxiety all this entailed upon those who sat on his side of the table. He had already mentioned that Mr. Tindall and he (the Chairman) had just returned from Berlin; but they were not the only members of the Board who had personally inspected the works in progress. Mr. Palmer, Mr. Lucas, Sir James Carmichael, Sir Charles Jessel, and Mr. Birchenough had all given their time recently to inspections on the Continent, and to discussing upon the spot matters technical and political, and (as a growing department of their business), he might add, electrical; and they sent home to their colleagues valuable reports upon what they had seen and done. One of the communes of Brussels —St. Gilles—had erected its own gas-works, and ceased to take its supply from the Association on Sept. 1 last. The commune had purchased from them the whole of the mains in the district, as well as the public lamps, services, &c., at a price which the Board considered satisfactory. The Directors had also been successful in recently entering into contracts for long periods with communes in the vicinity of Berlin and Brussels.

Mr. J. S. Littlewood said the Chairman in his remarks had stated that the price of coal continued to rise, and that this was compensated for to some extent by the increase in the price of coke He took it that this referred to the half year ended June 30, as compared with the corresponding period of 1900, and did not apply now. Like other gas companies, he supposed that the Association had made contracts for coal at a lower price, and that, although the price of coke might have declined, the cost of coal would be considerably less for the current twelve months than for the past year.

The Chairman replied that, in making a comparison of the cost of coal carbonized in the first half years of 1900 and 1901, it must be borne in mind that much of the coal used in the first six months of 1901 had been delivered under the previous year's contracts, and was charged at the price paid under such contracts. The comparison consequently referred not to the cost of coal *bought* in the half year under review, but to the coal *used* during that period. The contracts made in February, 1900, for English coal were at the rate of 16s. per ton f.o.b.; and as a large quantity of the coal carbonized in the first half year of 1901 was charged at this price, the average gross cost was thereby adversely affected. In February, 1901, their contracts were made at a considerably lower price, of which the Association had not yet reaped the benefit.

Mr. John Drew said he supposed the contracts extended over the whole year. As a matter of fact, he believed coals were now rising in price, so that the Directors had saved by making the contracts for twelve months. As to the mains that were taken up from the streets of Vienna, he asked whether they were of any value, or in a sufficiently good condition to use again.

The Chairman said that all coal contracts were made, as a rule, for periods of twelve months, the English contracts dating from February, and the majority of the foreign ones from the month of October. The mains that were taken up from the streets of Vienna were of value. The large ones were already in use in Berlin. The Association were obliged to remove the mains from the streets of Vienna, but the cost of doing so was covered by their value. He then formally moved the adoption of the report and accounts.

Mr. J. Horsley Palmer seconded the motion, which was unanimously carried.

The Chairman proposed that a dividend of 5 per cent. for the half year be declared on the £3,800,000 stock of the Association, free of income-tax. He remarked that paying the dividend free of income-tax added a considerable amount to it when the income-tax was at the rate of 1s. 2d. in the pound.

Mr. Arthur Lucas seconded the proposition, which was unanimously agreed to.

Mr. Drew moved a hearty vote of thanks to the Chairman and Directors for their conduct of the affairs of the Association. The Chairman had said the success that had been attained was a cause of congratulation to the proprietors; but he (Mr. Drew) thought it was also a cause for congratulation to the Directors. It must have been very satisfactory to them to be able to announce an increase in he consumption of gas to the extent of 11 per cent., and to inform the proprietors that the consumption was now very nearly equal to the loss sustained by the lapse of the Vienna and Amsterdam contracts. He did not gather from the Chairman's remarks whether carburetted water gas was being used at more than one station.

The Chairman: Two—Antwerp and Brussels.

Mr. Drew said he was glad to hear that. The accounts showed continued progress; and the large number of towns supplied by the Association must involve the Directors in a considerable amount of trouble and anxiety.

Mr. Bernard Harris seconded the motion, which was cordially agreed to.

The Chairman very heartily thanked the proprietors, and then moved a similar acknowledgment of the services of the staff both at home and abroad, which services, he said, had been rendered willingly, patiently, and continuously.

Mr. J. H. Birchenough seconded the motion, which was also unanimously carried.

This concluded the proceedings.

COLONIAL GAS ASSOCIATION, LIMITED.

The Annual General Meeting of this Association was held last Tuesday, at the London Offices, Suffolk House, Laurence Pountney Hill —Mr. Samuel Spencer in the chair.

The Secretary (Mr. A. J. Kingdon) read the notice calling the meeting and the Auditors' report. The report and accounts were then taken as read

The Chairman said he had to congratulate the shareholders upon the fact that their position was still steadily improving, and that they were enabled to pay an increased dividend at the rate of 4 per cent. for the year, and to add a further sum to the reserve fund—making its amount £2000. The reports from the Managing-Director (Mr. George Swinburne) dealt very fully with all the works. In one, he remarked: "I think there is every reason to expect a fair rate of increase during the next year, as most of the places we have works at are very sound, from an agricultural and productive point of view, and there is no fear we shall not maintain our present position." In common with all gas companies in this country and abroad, they had had to pay higher prices for their coals—some 2s. 9d. per ton for the last quarter covered by the accounts; but it would be remembered that last year they had fairly large stocks, so that the increase was kept down to the lowest amount possible. He was glad to say their purchases for the current year were more favourable; and therefore the Directors hoped to show a much better result in the next accounts. It was satisfactory to be able to announce that the increase in the consumption of gas during the past year was 10 per cent., and that the Association had 84 new consumers. These figures excluded the Bairnsdale station. It would be observed that the capital account had been increased by the issue of 1200 £5 shares, for the acquisition of the Bairnsdale works. Since the issue of the report, the loan of £2250 upon that property had been cleared off by selling the shares the Association held in the Metropolitan Gas Company of Melbourne and the Charters Towers Gas Company; and, in doing this, he was pleased to say they had made a profit of £440, which would go to the reserve fund in the next year's accounts. Since the last meeting, the Directors had been trying to obtain a Stock Exchange quotation, and had hoped they would have succeeded in being able to announce the result on this occasion. But he was afraid they would not be able to manage to get a quotation at present, as they were now informed that the issued capital must be in a larger proportion than what they had allotted. Under these circumstances, he thought they would have to continue as they were for some time longer. He concluded by proposing the adoption of the report and accounts.

Mr. W. C. Parkinson, in seconding the motion, remarked that they had now added a new works to their undertakings; and he thought he might say the terms on which they had purchased these works were entirely satisfactory. The Bairnsdale station held out the promise of being as profitable at any rate as any of the other works possessed by the Association.

Mr. W. Bew asked for information as to the shares held by the Association in other Gas Companies.

Mr. Parkinson replied that they had simply held shares in other Companies; but they had now sold those they possessed in two of them.

The Chairman said the explanation was that the shares they held in these Companies represented surplus funds that the Association had for disposal. Their Articles of Association gave them power to invest these funds in shares. They saw their way to making 15 or 20 per cent.; and so they realized the shares, and utilized the proceeds in paying off the loan on the recently purchased Bairnsdale works. As he had mentioned, the sale of two lots of shares had yielded them a profit of £440, which would go into the reserve fund in the current year's accounts.

The motion was unanimously carried.

The Chairman next proposed a dividend at the rate of 5 per cent. per annum, free of income-tax, making, with the interim payment, 4 per cent. for the year, and the transference of £334 19s. 2d. to the reserve fund. This dividend, he remarked, was ½ per cent. better than last year; and he saw no reason to doubt that they would go on increasing the dividend and adding to their reserve fund as well. If his hopes were realized, they would get into a stronger position, and see their shares at a higher price.

Mr. A. Goodwin Hammack seconded the motion; and it was unanimously carried.

On the proposition of the Chairman, seconded by Mr. Parkinson, Mr. Henry Andrews, jun., one of the local Directors, was re-elected; and subsequently, on the motion of Mr. Parkinson, seconded by Mr. Samuel While, Mr. Spencer was likewise returned to his seat at the Board. The proposer remarked upon the energy which the Chairman threw into his work for the Association.

Proposed by Mr. M. Curry, and seconded by Mr. G. Gregory Fisher, Messrs. Lass, Wood, and Drew were reappointed Auditors.

The Chairman and Directors, and the Managing-Director, Secretary, and staff were heartily thanked for their services; and the proceedings terminated.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Wednesday—Dr. T. W. Trend, J.P., in the chair.

The Secretary (Mr. C. C. Smith) having read the notice calling the meeting, the report of the Directors was taken as read. It stated that there was an increase of 12,956,000 cubic feet in the quantity of gas sold, as compared with the corresponding six months of last year; and that there was a rise of £8301 16s. 3d. in the receipts from this source. Upwards of 5000 prepayment meters had already been fixed, and others were in requisition. The amount available for distribution was £6422; and the Directors recommended the withdrawal of £3193 from the reserve fund, in order to pay the maximum dividend, amounting to £9615. They explained that this draft upon the reserve was necessitated by the extra cost of coal and oil; the increase, in July last year, of 6d. per 1000 cubic feet in the price of gas not being sufficient to meet the abnormal additional expense.

The Chairman, in moving the adoption of the report, first referred to the regretted death of the late Chairman, Mr. R. C. Hankinson, J.P., whose loss was severely felt by the Board. On looking over the accounts, the first prominent fact to notice was the necessity of taking £3193 from the reserve fund to make up the amount required to pay the maximum dividends. To his mind the reserve fund was one of the strongest points in the Company. In the last half year, as the shareholders would see, there had been an enormous increase in the cost of coal and oil; and this had made it necessary to go to the reserve fund. But when the £3000 was drawn out, they would still have £18,000 more to fall back upon. The Directors, however, anticipated a much more favourable balance of profit during the current half year than they were now able to report. In the receipts for coke, tar, and sulphate of ammonia, there had been a large reduction. But the sale of gas had increased during the half year by 13 million cubic feet, as compared with the June half year of 1900—this amount representing an increase of 5½ per cent., while the money increase represented the substantial sum of £8300. The Company had above 5000 slot meters in use; and the Directors anticipated a further demand from districts not yet supplied. These facts were satisfactory—showing, as they did, the continued progress of the business. The Directors had had the question of price before them; and as soon as circumstances justified it, a reduction would be made in the interests alike of consumers and of the Company. There were extensive new works, including a large holder at Northam, still in progress. The capacity of the new holder would be about 2 million cubic feet.

Captain Corse-Scott seconded the motion.

One or two shareholders made criticisms which pointed to their discontent with the position of the Company; but others—realizing the exceptional period through which the Company, in common with others, have been passing—were convinced as to the soundness of the undertaking.

When the motion was put, it was unanimously carried.

The maximum dividends were next declared.

A Special Meeting was then held, at which the Chairman moved a series of regulations, authorizing the Directors to issue further stock and raise further debenture capital in accordance with the Company's Act of 1898.

Captain Corse-Scott seconded the motion.

Mr. Baxter asked what balance the Directors had power to raise.

The Chairman replied £100,000 of stock and £55,000 of debentures. The Board would not raise the money all at once, but would issue the stock from time to time as required.

The proposition was unanimously carried.

Votes of thanks to the Chairman and Directors, the Secretary, and the Manager (Mr. S. W. Durkin) concluded the proceedings.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1227.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	12⅜—13½	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb.	100—102	..	4 18 0
200,000	5	May 15	6½	Bombay, Ltd.	6¼—6⅝	..	4 16 4
40,000	5	,,	6½	Do. New, £4 paid	4¼—4½	..	5 9 5
380,000	Stk.	Aug. 15	12	Brentford Consolidated	265—270	..	4 8 11
270,000	,,	,,	9	Do. New	192—197	..	4 11 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	130—135	..	3 14 1
206,250	,,	June 14	4	Do. 4 p.c. Deb.	114—117	..	3 8 5
220,000	Stk.	Sept. 12	10	Brighton & Hove Orig.	222—227	..	4 8 1
246,320	,,	,,	7	Do. A. Ord. Stk.	155—160	..	4 7 6
1,047,500	Stk.	Aug. 28	5	Bristol, 5 p.c. max.	119—120	+½	4 3 4
420,000	20	Sept. 27	10	British	41—42	..	4 15 3
50,000	10	Aug. 15	12	Bromley, Ord. 10 p.c.	24—26	..	4 12 4
82,850	10	,,	9	Do. 7 p.c.	19—21	..	4 5 8
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	9—9⅝	..	6 6 4
220,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	July 17	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	Sept 27	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
550,000	Stk.	Oct. 11	12	Commercial Old Stock	270—275	..	4 7 3
236,425	,,	,,	9	Do. New do.	203—208	..	4 6 7
238,237	,,	June 14	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	May 31	9	Continental Union, Ltd.	165—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	162—167	..	4 3 10
575,000	Stk.	Aug. 29	5	Crystal Palace Ord. 5 p.c.	122—127	..	3 18 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—128	..	3 18 2
486,090	10	July 17	10½	European, Ltd.	19—20	..	5 5 0
354,060	10	,,	10½	Do. £7 10s. paid	14—15	..	5 5 0
15,079,885	Stk.	Aug. 15	4 16/16	Gas-light and Coke: 4 p.c. Ord.	97—99	..	4 8 10
2,600,000	,,	,,	3½	Gas-light and Coke: 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke: 4 p.c. Con. Pref.	112—115	..	3 9 7
4,063,425	,,	June 14	3	Gas-light and Coke: 3 p.c. Con. Deb.	92—94	..	3 3 10
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	May 15	10	Imperial Continental	213—216	..	4 12 7
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Aug. 29	10	Liverpool United A	231—233	..	4 5 10
718,100	,,	,,	7	Do. do. B	170—172	..	4 1 5
306,083	,,	June 28	4	Do. do. Deb. Stk.	119—120	..	3 6 8
75,000	5	June 14	4	Malta & Medn., Ltd.	4½—5	..	4 0 0
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	105—108	+1	4 12 7
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd.	9½—10½	..	6 13 4
717,946	Stk.	Aug. 9	8½	Newc'tle & G'tesh'd Con.	214—216	−2½	3 18 8
312,855	Stk.	June 28	3½	Do. 3½ p.c. Deb.	97—99	..	3 10 8
150,000	5	May 15	8	Oriental, Ltd.	7⅞—8¼	..	4 17 5
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7⅞	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1⅝—1⅞	..	4 11 5
				* Ex div.			

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Sept. 27	7	Ottoman, Ltd.	5⅜—6½	..	5 12 0
851,070	10	Oct. 11	7	River Plate Ord.	10½—11	..	6 7 3
250,000	Stk.	June 28	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Sept. 27	8	San Paulo, Ltd.	11—12	..	6 13 4
135,000	Stk.	Sept. 12	10	Sheffield A	240—243	..	4 2 4
209,984	,,	,,	10	Do. B	240—243	..	4 2 4
523,498	,,	,,	10	Do. C	240—243	..	4 2 4
5,761,885	Stk.	Aug. 15	5	South Met., 4 p.c. Ord.	123—125	..	4 0 0
1,627,965	,,	July 17	3	Do. 3 p.c. Deb.	91—94	..	3 3 10
380,940	Stk.	May 15	5	Southampton Ord.	104—109	−3	4 11 9
70,825	,,	July 17	4	Do. 4 p.c. Deb.	104—109	..	3 13 5
120,000	Stk.	Aug. 29	5½	Tottenham and Edmonton: A. 5 p.c.	122—127	..	4 6 8
250,520	,,	,,	4	Tottenham and Edmonton: B. 3½ p.c.	95—100	..	4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	95—100	..	5 0 0
230,000	5	Aug. 15	9	West Ham, 10 p.c.	9½—10½	..	4 5 9
172,000	10	,,	6	Do. 7 p.c.	12½—13½	..	4 8 11
140,900	Stk.	June 28	4	Do. 4 p.c. Deb.	107—112	..	3 11 5
				WATER COMPANIES.			
780,599	Stk.	June 28	11	Chelsea, Ord.	312—317	..	3 9 5
150,000	,,	,,	5	Do. 5 p.c. Pref.	152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Sept. 27	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Oct. 11	7	East London, Ord.	200—205	..	3 8 4
654,740	,,	June 14	4½	Do. 4½ p.c. Deb.	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb.	96—98	..	3 1 3
700,000	50	June 14	8	Grand Junction: 10 p.c. max.	115—118	..	3 7 10
310,000	Stk.	Sept. 27	4	Grand Junction: 4 p.c. Deb.	122—126	..	3 3 6
708,000	Stk.	Aug. 15	14	Kent	290—295	..	4 14 11
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—205	..	3 8 4
1,043,800	100	June 28	10½	Lambeth, 10 p.c. max.	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p.c. max.	217—222	..	3 12 1
350,000	Stk.	Sept. 27	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
500,000	100	Aug. 15	12 8/10	New River, New Shares	395—405	..	3 3 2
1,000,000	Stk.	July 31	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
902,300	Stk.	June 14	6	Southwark and Vauxhall: Ord.	198—203	..	2 19 1
126,500	100	,,	6	Southwark and Vauxhall: 7½ p.c. max.	185—190	..	3 3 2
489,200	Stk.	,,	5	Southwark and Vauxhall: 5 p.c. Pref.	147—152	..	3 5 9
1,019,585	,,	Oct. 11	4	Southwark and Vauxhall: 4 p.c. A Deb.	124—129	..	3 2 0
1,155,066	Stk.	June 14	10	West Middlesex.	290—295	−2½	3 7 10
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	138—143	..	3 2 11
200,000	,,	Sept 12	3	Do. 3 p.c. Deb.	94—97	..	3 1 10
				* Ex div.			

BIRKDALE GAS SUPPLY.

The Proposed Reduction in Illuminating Power.

At the Monthly Meeting of the Birkdale District Council last Tuesday, the Lighting Committee reported against the proposal of the Southport Corporation to reduce the illuminating power of the gas supplied in Birkdale from 20 to 14 candle power (*ante*, p. 795). The Chairman of the Committee (Mr. Clinning), in reply to a question, said that Mr. Bellamy's report, on which this decision had been arrived at, was open to the members of the Council; but just now he did not think it wise to show their hand to the general public. At the present moment, the Southport Corporation had to supply 20-candle gas; yet the tests by the Birkdale Council's Gas Engineer showed that on Oct. 4 the illuminating power was only 12·22 candles, and on the 24th 15·01 candles. These tests proved at once that Birkdale residents were not getting the illuminating power they should have. If the Southport Corporation were empowered to give them 14-candle power, he supposed Birkdale would get gas of 6 or 8 candle power. When a reduction was spoken of, it was a reduction at a preferential rate, because Southport got a reduction of 6d.; so that Birkdale was really paying 6d. in advance of Southport. He did not know what the Southport Corporation intended to do. They might go for parliamentary powers to reduce the candle power; and that being so, he thought the less the Birkdale Council said about the matter the better. The report was adopted.

GAS v. ELECTRIC LIGHT IN FOG.

In a letter which appeared in "The Times" last Thursday, Mr. L. F. Vernon Harcourt, M.Inst.C.E., testified in the following terms to the superior penetrating power of gas compared with electricity for public lighting in foggy weather: "An opportunity presented itself during the recent fog, in walking down Gower Street, of observing the relative efficiency of the arc, duplex incandescent, and ordinary gas-lights in foggy weather, as the thoroughfare is lighted at different parts by the three systems. The arc lights near University College gave a brilliant light close to the high standards, but midway between the standards they were entirely obliterated by the fog; and the complete darkness appeared the more intense after the preceding illumination near the standards. Farther on, the double incandescent gas-lights in the ordinary gas-lamps, being much lower and nearer together than the arc lights, were never lost sight of, and afforded as good a light as could be expected under such unfavourable conditions. The ordinary old-fashioned gas-lights, reached at Bedford Square, afforded a decidedly less effective illumination than the duplex incandescent lights, but very much superior to the arc lights, with their intervals of brilliancy and total obscurity succeeding one another. Moreover, just beyond Bedford Square a low, brilliant electric arc light at the entrance to some flats happens to be close alongside an ordinary gas-light; and on proceeding towards Oxford Street the two lights, though presenting a great contrast close by, were almost simultaneously lost sight of through the fog. These observations prove that electric arc lights, as being put up in London, owing to their height, their distance apart, and their relative deficiency in penetration through fogs, provide a most unsatisfactory method of lighting in foggy weather such as London is so subject to in the winter months. It, therefore, appears expedient that the authorities responsible for the lighting of the London streets should be warned of this defect of arc lights as at present erected, and, especially in those streets devoid of the advantage of the lights of shops, should provide a supplementary means of lighting with gas in time of fog." Reference was made in our "Electric Lighting Notes" last week to the very unsatisfactory behaviour of the electric lights in Canterbury. The fog which prevailed on Monday evening last week tried them severely. According to a local paper, it was necessary to "hold both hands well before one, to prevent colliding with the lamp-posts." This precaution was needed, it appears, less on account of the thickness of the fog than of the weakness, amounting almost to absence, of the electric light. The Ramsgate Corporation are considering the question of electric lighting for the borough, and one of the members (Mr. Port) recently paid a visit to Canterbury to see what was being done there. He pronounced the lighting to be the most miserable he had ever seen. The lamps were about 40 yards apart, and it was difficult to see from one to the other. If this was the case on probably a clear night, one can well imagine how the lights comported themselves in the fog.

ELECTRIC LIGHTING NOTES.

At the meeting of the London County Council to-day, the Parliamentary Committee will ask for authority to advertise notice of a Bill dealing with the purchase of undertakings for the supply of electricity in London.

It is expected that the electricity supply for lighting purposes in Maidstone will be ready for "turning on" by Dec. 18—just in time, if the installation follows the eccentricities of some of its predecessors after the opening day, to add to the fun of Christmastide.

The Corporation of Dover last Friday agreed to purchase the electric light works, and to apply for parliamentary powers for the purpose. At present they take a great amount of current for their electric tram system, and for public lighting. The capital of the Dover Electricity Supply Company is £100,000.

It is stated that the accounts for the past year of the Wolverhampton electric light undertaking show a loss of £130; but it is pointed out that the sum of £545 was expended out of revenue in changing the system of supply. The private consumption in the period under review shows an increase of 26·6 per cent. over the previous year.

The electric light and refuse destructor works at Rhyl, which have

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Tar-Distilling Plants. Claus' Sulphur-Recovery Plants.

SULPHATE OF AMMONIA PLANTS.

been constructed at a cost of £30,000, were opened on Thursday last. The dynamos have an output of 165 kilowatts, at a speed of 380 revolutions per minute. In all some 16 miles of cable have been laid. The lamps and consumers already connected represent about 2000 8-candle power lamps. There are also 56 arc lamps; 36 of them being erected along the promenade.

Weybridge possesses the distinction of having been one of the first towns in the country to have the electric light in the streets, then to discard it, and now to re-introduce it. The new installation is being undertaken by a concern called the Urban Electric Supply Company, which is an offspring of Edmundson's Electricity Corporation, Limited. The plant which is to be laid down in the first instance will be capable of supplying 10,000 8-candle power lamps; and the current will, it is anticipated, be ready by Easter next.

An inquiry on behalf of the Local Government Board was held by Mr. H. P. Boulnois, on Tuesday last, into the proposal of the Worcester City Council to erect and equip a supplementary electricity generating station, at a cost of £31,111. The new works have become necessary by reason of the conversion of the tramways to electric traction; and it is proposed to give the British Electric Traction Company, who have acquired the powers to run the trams in the city and district, notice fixing Dec. 1, 1902, as the date for the commencement of the supply of current for traction purposes. The Town Clerk (Mr. S. Southall) laid the proposal before the Inspector, and no opposition was offered.

Penarth is now able to enjoy the luxury of electric lighting; the installation of the Electric Power Distribution Company having been completed to the satisfaction of the Board of Trade. The scheme provides for street lighting; the Company having erected half-a-dozen arc lamps, whose "superiority over gas will doubtless create a demand on the part of the town that the principal thoroughfares at any rate shall be electrically lighted"—see local Press. The maximum demand system of charging has been adopted. The system employed is the continuous current, with a voltage of 230; and a battery of accumulators has been erected, so that the station may be shut down at night.

A praiseworthy endeavour on the part of the Swansea Corporation to do away with Sunday labour at their electric light works, led to some inconvenience on the 3rd inst. The plant is never in operation on Sundays; the current required being stored ready on Saturday. Every Sunday morning, however, the mains are tested; and to do this, it is necessary to temporarily switch off the current. On the day in question, after testing the mains, the workman went away without turning the current on again. Fortunately the omission was noticed during the evening, and the switches were put back. It was stated that this trouble would not occur again, even on Sundays, for arrangements had already been made to so increase the staff that in future there will be men on duty every day of the seven.

The Exeter City Council finally came to a decision last Wednesday on the subject of the tenders for the new electricity station. After considerable further discussion, the amendment which had been proposed in favour of a redrafting of the specification and inviting fresh tenders was rejected by 23 votes to 14. The recommendation of the Electric Light Committee that the tender of the Westinghouse Company, in the total sum of £29,707, be adopted, was then agreed to, with the proviso that the draft contract be approved by an expert, and that the plant be tested on completion and at the expiration of twelve months from the commencement of working. Application is to be made to the Local Government Board for power to borrow £65,000 for the purposes of the undertaking. This includes £30,000 for plant at the new station, £14,000 for the buildings, and £16,000 for mains; the balance being made up of the cost of the land, railway sidings, &c.

The "West Briton" newspaper has a correspondent at Redruth who is of an observant turn of mind; for, reporting that the Urban Electric Supply Company, Limited, have applied to the Urban District Council for an opportunity to tender for the public lighting in about nine months' time, he remarks: "So far so good; but it does not follow that because they tender they will win. 'Coming events cast their shadows before,' in a very decided manner sometimes, too. There is clearly to be a struggle. People have been noticing the beautiful and brilliant incandescent light at the bottom of Station Hill. There are incandescents *and* incandescents; and this one is very different from all others ever seen in the town. The words 'Welsbach System' painted in large letters on the glass show that it is put there with a special purpose; and as the Gas Company are the local agents, it is evident that the battle of the future will be gas *plus* Welsbach *versus* electricity."

Two conferences of the Finance Committee of the Sheffield Corporation with the Chairmen of the various standing Committees have lately been held, with reference to certain suggested capital expenditure by the Health and Electric Light Committees. The proposal in regard to the latter Committee comprises the sum of £500,000, of which a detailed estimate was submitted to the conference. A forecast of the expenditure and revenue of the undertaking for the next four years was also submitted. Based on the actual figures for the 15 months ended March 25, 1901, the Committee estimated the following results: For 1902, capital expenditure, £525,926; gross revenue, £46,449; cost of production, £18,579; interest on sinking fund, £22,858; surplus, £5012. For 1903, capital expenditure, £753,923; gross revenue, £60,383; cost of production, £24,153; interest on sinking fund, £39,080; estimated deficit, £2850. For 1904, capital expenditure, £859,370; gross revenue, £75,479; cost of production, £30,191; interest and sinking fund, £45,198; estimated surplus, £140. For 1905, capital expenditure, £870,443; gross revenue, £90,575; cost of production, £36,230; interest and sinking fund, £45,782; estimated surplus, £8565. This would make a net surplus on March 25, 1905 (including the surplus to the present date), of £17,161. The conference approved of the proposed expenditure.

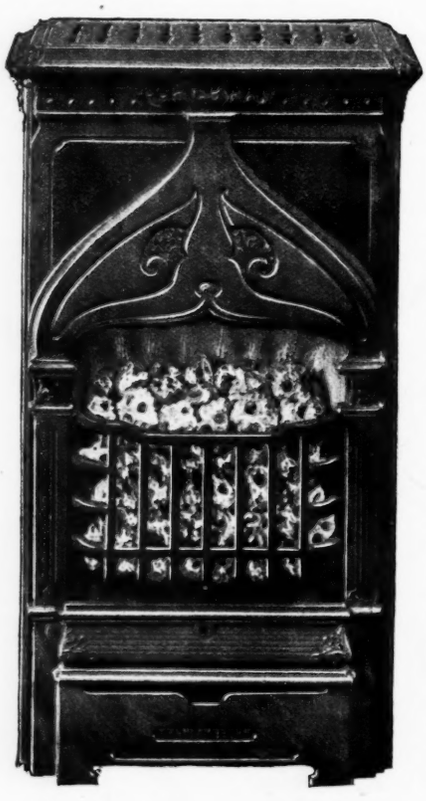
The Cromer Urban District Council recently had before them once more the question of introducing electric lighting into the town. It came up on a report presented by the Highways Committee, of which Mr. H. Broadhurst, M.P., is the Chairman. In moving its adoption, he reviewed the history of the electric light movement during the past three years, and stated that the Council had come to a pretty clear

decision that they could not themselves undertake to erect works and lay cables for the supply of the light. As their Order had only four or five months to run, they thought they had better get rid of it on the most advantageous terms possible. The Committee had received an offer from Edmundson's Electricity Corporation, Limited, to carry out a scheme on condition that the Council should raise a loan, upon which the Corporation would pay the principal and interest for 14 years, at the end of which period the Council could take over the concern if they thought proper, with the remaining liability for the loan. The Council would therefore not run any risk until they acquired the works. The difference between their own scheme and that of the Corporation was that under the latter a greater length of cable would be provided; and the whole thing would be maintained under the supervision of the Council's Engineer (Mr. Cozens-Hardy), who had approved of the arrangement. Mr. Broadhurst concluded by saying he understood that it would be possible to have the agreement all through by Christmas, and the electric light supplied within a year from now On a division, the proposition was agreed to with one dissentient.

Electricity is in the air at Louth, and if the ratepayers are not careful they will find themselves deluged by a storm. Various ominous murmurs have been heard for some weeks past, and they appear to have assumed definite shape in the calling of a special meeting of the Town Council for the 21st inst., to consider, and if thought desirable to pass, a resolution sanctioning an application for a Provisional Order to enable the Town Council to supply electricity throughout the borough. Louth is not a very large place—having a scattered population of about 10,000; and inasmuch as there are but ten miles of street lighting, with nothing to support electric traction, the prospect of making the supply of electricity pay does not appear very brilliant. If, in their desire to be quite up to date, the worthy burgesses have not carefully considered the scheme in the light of the experience gained in other places, they owe one of their number their thanks for placing in their hands some information which may prevent them from rushing headlong into extravagance which they might subsequently have cause to regret. The burgess who has performed this service is Mr. Joseph Store, who has been circulating a little pamphlet containing some instructive particulars as to the cost of electric lighting and incandescent gas lighting. Being largely interested in the Gas Company, Mr. Store naturally looks to his statements being criticized. But he simply adduces facts, and leaves his readers to draw their own conclusions from them. He submits that an electricity undertaking, even under favourable conditions, is a very costly and risky form of municipal enterprise, and that there are very few, if any, instances of municipal electric lighting installations, without traction, being able to make a contribution towards the relief of the rates. On the contrary, they not infrequently result in a considerable deficit, and have to be subsidized out of the rates. Mr. Store fully establishes his position. He cites as an example the neighbouring town of Sleaford, where, far from helping the rates, it will cost the ratepayers 6d. in the pound to keep the concern going, with less satisfactory lighting than they had by gas. If the Louth people are willing to pay for more light in their streets, they can have it at less cost than they would have to incur for an electrical installation, and probably with much more satisfactory results. But if they are determined to touch electricity, they may find, as Mr. Store says on the wrapper of his pamphlet, that it will produce "electrolysis of £ *s. d.*"—or, in plain language, "decomposition or dispersion of the ratepayers' money."

A position which seems to be a bit complicated has been created at Walker in connection with the supply of electricity; and the Clerk of the District Council (Mr. Sturgess) has drawn up a report in regard to the matter. He first explained that during the session of 1899, the Walker and Wallsend Union Gas Company introduced a Bill empowering them to supply electrical energy in their gas area, which consisted of Walker and two other urban districts, and one rural district. The Council did not approve the Bill so far as their district was concerned, and applied for a Provisional Order, which was granted. Money was borrowed by the Council for the purposes of the Order; and they entered into an agreement with the Newcastle Electric Supply Company to execute the necessary works, and to take upon themselves during ten years the whole of the duties, obligations, and liabilities for the supply of electric energy within the Council's district. These works were being proceeded with as quickly as possible; but although Walker was struck out of the Gas Company's Bill, the Company had laid two sets of electric mains into the district. Acting upon the advice of Counsel, the Council applied to the Attorney-General for his fiat to join as co-plaintiff in an action against the Gas Company for an injunction to prevent the Company sending the supply of energy outside their electrical area into the Walker district. The fiat had been granted. The object of the Gas Company, it was alleged, was to supply the best-paying customers in Walker—viz., the manufacturers on the river side—leaving the comparatively unprofitable private lighting for the Council. When the Council applied for the order, it was with the full intention of generating their own electrical energy; and this intention was only deferred for ten years, owing to the offer of the Newcastle Company. But the Council do not see how any scheme in the district could be made to pay if nearly all the large consumers were to be allowed to take their supply from another source. If, in addition to this, the Gas Company were (says the report) to be allowed to carry their cables over public thoroughfares with impunity, there was no reason why they, having no statutory powers to bind them, should not finally absorb the whole district. The Council were, Mr. Sturgess pointed out, in the position of having raised a considerable sum of money, with the sanction of the Local Government Board, in order to supply electrical energy, and now at the last hour, after having incurred these responsibilities, they found themselves faced by a competition which would be ruinous if the facilities the competitors had availed themselves of were legal. The issue will be awaited with interest.

According to a copy of the "Perth (W.A.) Herald" for the 4th ult., water is a dear commodity at Davyhurst. It costs 30s. per 100 gallons. We may be pretty sure there is not much waste over there.



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LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Purchase Bill to be Revived.

At the Meeting of the London County Council last Tuesday—Mr. A. M. TORRANCE in the chair—the report presented by the Water Committee on the previous occasion (*ante*, p. 1114), containing a recommendation that a Bill to sanction the purchase by the Council of the undertakings of the Metropolitan Water Companies, on similar lines to that of last session, should be introduced in the session of 1902, came up for consideration.

The adoption of the report having been formally moved and seconded,

Mr. R. A. ROBINSON said he understood the contention of the Water Committee was that the proposed Bill should be introduced as a kind of precautionary measure, inasmuch as it was not clear what the Government might do. But it seemed to him that the President of the Local Government Board had distinctly stated to the deputation from the Council, and afterwards in his place in the House of Commons, that he would deal with the matter in the ensuing session. He (Mr. Robinson) approached the question from a municipal point of view, and he suggested to the Chairman of the Committee that if he was assured that a Bill would be introduced by the Government, it would be unwise to press the Bill of the Council. Mr. Long had deliberately committed himself to deal with the water question; and he (Mr. Robinson) saw no reason why the promise should not be kept. He was able to assure the Council that the Government would bring in a Bill, and that notices were to be given for it before the 20th of this month. He therefore asked if it was wise or expedient for the Council to place themselves in the position of offering opposition to the Government. He moved, as an amendment—"That, in view of the declared intention of the Government to introduce a Bill in the ensuing session for the creation of a water authority and the purchase of the Water Companies' undertakings, it is inexpedient for the Council to introduce a Bill dealing with the subject."

Mr. P. HARRIS formally seconded the amendment.

Mr. M'KINNON WOOD (the Chairman of the Committee) said he was surprised that information which had not been vouchsafed to the Council should have been given to Mr. Robinson. That gentleman said he was anxious to deal with the matter from the municipal point of view. But what was the municipal point of view? It was that, with the exception of London, every other municipality brought their proposals before Parliament; and the function of the Government was limited to seeing that there should be a fair field and no favour. Had that been their fate in London? (No, no.) They had gone again and again to the Government, whose action, from first to last, had been in the direction of strengthening the position of the Water Companies, and increasing the value of their shares. While the Government had been delaying purchase, the gross income of the Companies had been steadily growing. In 1895, when the Council nearly succeeded in passing their Purchase Bill, the gross income of the Companies was a little over £2,000,000; but in 1899 it had grown to £2,365,000. This was entirely due to the action of the Government, in whom they were asked to place implicit confidence. He could not help thinking that now the Companies were assured that the settlement of the question was to be taken from the hands of the Council, they would see in it an enormous pecuniary advantage. During the period in which other securities had fallen, the shares in the Companies had been advancing by leaps and bounds. He maintained that the Council had a direct mandate from their constituents to go once more before Parliament, so that there should be an opportunity for the people of London to judge between the proposals of the Council and those of the Government. They would doubtless be accused of wasting the ratepayers' money; but while the Stock Exchange value of the Companies' shares had risen £1,800,000, the cost of giving notice of their intention to introduce a Bill was only about £150. If they introduced it, the expense would be only £500; and there would be no large outlay unless the Bill passed the second reading. They should go to Parliament for three reasons: First, they did not know whether or not the Government were going to bring in a Bill; secondly, they did not know whether it would be a Bill for creating an authority and not for purchase; and, thirdly, if it was a Bill for creating an authority and for purchase, the Council were bound, in safeguarding the interests of the ratepayers, to submit their proposals.

Mr. SANKEY supported the amendment, on the ground of the waste of money involved in the proposal. Since 1894-5, they had spent something like £60,000 in promoting Bills on water legislation, and another £20,000 in looking out fresh sources of supply. He thought it undesirable that they should spend more money at a period when ratepayers were hard pressed, especially as there was no doubt that the Government would bring in a Bill to deal with the water question.

Mr. DICKINSON said the Council's experience of His Majesty's Government with regard to water had not been such as to inspire them with any great confidence. In 1896 the Government stepped in, and refused to allow the Council's Bill to become law. On the basis only of increased rateable value, he found there was an income of £200,000 a year more which would have accrued to the Council if their proposals had passed, and which had accrued to the Companies because the Council's Bills were refused by Parliament. This would represent, at 30 years' purchase, £6,000,000; and it was this which London had to thank the Government for in interfering with their domestic concerns. The introduction of the Council's Bill was to save London from being absolutely put under the thumb of the communities round about it, and from having thrust upon it a scheme of purchase under which the Water Companies would receive some £8,000,000 to £10,000,000 more than their undertakings were actually worth in the market, and which would handicap the Council in the administration of the water supply in the interests of London.

Mr. EMDEN, speaking as one who had always been in favour of purchasing the Water Companies' undertakings, said it was not fair and

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just for the Progressives to take the line they had. It was the action of their party which prevented the undertakings from being purchased under the Cross scheme years ago.

Dr. COLLINS contended that the Council must be supreme within the area of their own jurisdiction. They did not want another authority.

Mr. P. HARRIS said the question before the Council was: What useful purpose was to be served by introducing the Bill? Last session they had quite as much mandate as now; and yet the Bill failed to commend itself to the Government. If there was any doubt as to the Government bringing in a Bill, he would vote for the recommendation; but they could tell from the speeches of Mr. Wood and Mr. Dickinson that these gentlemen knew there was to be such a Bill. They would all like to see the question settled; and he thought it probable that, when they saw the Government measure, the Council would devote themselves to considering whether they could not assist in getting the best possible Bill through Parliament.

Mr. CORNWALL said he believed that if the Council ceased to introduce their Bill the Government would do nothing whatever in regard to water supply.

Mr. COHEN treated the question as one of opportunity, and to be dealt with entirely upon financial grounds. There had been no caucus of the Moderate party on this subject. Two new factors had arisen in the creation of the Metropolitan Boroughs and the depreciation of London County Council stock; and he apprehended that a great financial difficulty would occur if the Council had to raise money to buy out the Companies. A public body always got the worst of it as a purchaser, and the appreciation of water shares was due to the fact that the Government and the County Council were regarded as two eager buyers, while eight unwilling sellers were holding back. The Borough Councils would lose £250,000 in rates by the purchase; and following the analogy in the fall of Consols, the County Council would suffer a further depreciation of their stock to the extent of 6 or 7 per cent. This would involve the abandonment of improvements, and would utterly discount any advantage to water consumers. To buy at the top of a pushed-up market was to make the ratepayers smart; but he believed that by waiting a while they would find the extra £1,800,000 of value disappear, and that a better chance would present itself.

Mr. BURNS, M.P., regarded the objections to the Bill as unimportant. He said the depreciation of the Council's stock was not due to any action of the Council, but to the conduct of the Government in flooding the market with gilt-edged securities, to pay for the war. The Bill must be introduced, if only to assert the municipal principle and to redeem electoral pledges.

Discussion was continued by Mr. GASKELL and Mr. RADFORD.

Lord WELBY said Mr. Cohen had brought rather a bogey before the Council in raising the question of the depreciation of their stock. With regard to the fall in Consols, it must be remembered that the Government had entirely suspended the sinking fund; and, in addition, the price of Consols for some years had been unduly high. Again, within a short period, the interest would be reduced. They could not contrast the throwing of £60,000,000 of Consols on the market with the placing of £40,000,000 of County Council stock to buy out the Water Companies. In the case of the Council, it meant the purchase of remunerative undertakings, and the Council would have a valuable asset; whereas the large sums of money raised for war purposes were unproductive.

On a division being taken, the voting was as follows: For the amendment, 29; against it, 82—majority against, 53.

The recommendation was then agreed to.

TEIGNMOUTH WATER SUPPLY.

The Teignmouth District Council came to a decision last week which, if it does not lead to the rejection of the offer of the Torquay Corporation to provide a supply of water for the town, is at least likely to postpone the settlement of the question for twelve months. In reply to a request from the District Council that the terms of their offer should be modified, the Water Committee of the Corporation wrote that they were unable to accede to the request, and at the same time pressed for an immediate decision of the question in order that steps might be taken for promoting a Bill next session. Some of the members were, however, anxious that further negotiations should proceed. It was pointed out that, as matters stood, if the rateable value of the town decreased, an extra rate would have to be imposed to make up the minimum revenue which Torquay required for the water service; while if it increased, Torquay would reap all the advantage. In reply, it was said that the objection was imaginary, because the 3s. rate proposed would yield more than the £3800 a year which Torquay required to be guaranteed. An attempt was made to induce the Council to accept the principle of the Torquay offer, leaving the details for subsequent arrangement. This, however, failed; the Council, by five votes to four, adopting an amendment to the effect that an offer of a 2s. rate should be made to Torquay—the paying off of the existing debt being left to Teignmouth. In the course of the meeting, a letter was read from Mr. G. F. Deacon, who had reported on the Hyner Valley gravitation scheme, which the District Council recently adopted, and have since dropped. Mr. Deacon said he was sorry to hear that the Council were likely to make an arrangement which would give the Corporation of Torquay most of the benefit to be derived from the Teignmouth water undertaking. He had heard of a great many cases of Urban Councils assuming independent water supplies to their great advantage, but never of the converse, where the towns were in similar relation to Torquay and Teignmouth, and where the smaller town could do so much better for itself.

It was reported at last Wednesday's meeting of the Kettering District Council that the total cost of the Water Act of last session would amount to between £3400 and £3500. It was resolved to submit the costs for taxation.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. R. M. Mitchell has this week been re-appointed Convener of the Gas Committee of the Glasgow Corporation; and Mr. H. Russell has been re-elected as Convener of the Gas Committee of the Falkirk Corporation.

Another Corporation which must be mentioned with congratulation is that of Peebles. Having resolved to pave a street in the town, they have called for a report on the condition of the gas, water, and sewage pipes in the thoroughfare, in order that, if necessary, they may be put right before the work is begun. The sewage pipes have been found to be sufficent; and the water-main is to be enlarged for part of the way. As to the gas-pipes, the Corporation Gas Manager (Mr. A. Bell, jun.) is to examine the condition of the service-pipes as the work of paving proceeds, and to repair them where necessary, by which means separate openings of the street will be unnecessary, and a great saving of expense will be effected. Happy Peebles, for in it the dream of municipal reformers has been at last realized!

The Coatbridge Gas Company are about to apply to Parliament for a Provisional Order giving them powers to increase their share capital and to reduce the illuminating power of the gas. At present, the standard is 20 candles, though 22-candle gas is given. The Company have intimated their intention to the Town Council, a Committee of which have the matter under consideration, with a probability that they will oppose the application.

I have been favoured with a copy of the accounts of the Gas Department of the Corporation of Kilmarnock, for the year ending June 14 last. The total revenue was £24,817, and the expenditure £22,622; leaving a surplus of £2195. Out of this there was set apart for sinking fund £700, and accounts were written off to the amount of £37, which left a net surplus of £1458 to add to the profit and loss account. This account started with a debit balance of £2288, which is now reduced to £828. The revenue from gas was £20,492, from tar £2903, and from coke £1374. The coal carbonized was 15,085 tons, as compared with 14,173 tons the previous year. The price of coal was £12,274, as compared with £9276; the average cost being 16s. per ton, as against 13s. 1d. There was manufactured 144,814,500 cubic feet of gas, or an increase of 5,917,900 feet (equal to fully 4 per cent.), during the year. The average production of gas per ton of coal was 9600 cubic feet, as compared with 9800 cubic feet; the decreased yield being due to working an inferior coal in order to keep down the price. The gas sold amounted to 131,179,900 cubic feet, or an increase of 5,482,525 cubic feet; the leakage being 13,634,800 cubic feet, or 9¾ per cent., which was about ¼ per cent. less than the previous year. Wages amounted to £4674, an increase of £182. The profit earned was £159 more than in the preceding year. The amount of tar produced was 219,124 gallons, or 28,336 gallons more; and the revenue from it showed an increase of £235. The yield of tar per ton of coal was 14·52 gallons, as compared with 14 gallons. The quantity of sulphate of ammonia produced was 194 tons, as against 167 tons; and the revenue was £2017, or an increase of £250. This increase is attributed to the satisfactory working of the new scrubber. The quantity of sulphate per ton of coal was almost 29 lbs., as compared with 26¾ lbs. As I have said before of the Kilmarnock Corporation gas accounts, they are prepared upon a system which is so admirable that the effect of the year's working, in any and every department, is plain at a glance.

The road-roller has been responsible this week for large escapes of gas in Brechin. Several big leaks were discovered and stopped; and it was hoped the trouble was at an end. Next morning, however, it was found that the station meter registered 24,000 cubic feet of gas more than it should. Search was then made in a thoroughfare where the roller was at work, with the result that nine other fractures of gas-pipes were discovered. The Gas Company approached the Town Council on the subject; and this body (to their credit be it said) agreed to stop the rolling operations, so as to enable the Company to look into the condition of their underground plant.

The annual meeting of the Turriff Gas Company was held last week. It was reported that the quantity of gas manufactured during the twelve months was the highest which had ever been recorded by the Company. A dividend at the rate of 5 per cent. for the year was declared.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 9.

Sulphate of Ammonia.—The hardening tendency of the market during the past weeks has developed into greater activity and improved prices all round; the closing quotations being £10 15s. per ton f.o.b. Hull, £10 18s. 9d. to £11 per ton f.o.b. Leith, and £11 1s. 3d. per ton f.o.b. Liverpool. There has been less disposition to postpone covering sales made in advance. Concurrently, quotations abroad have been increased, and a good direct business has been done; so that all available supplies have readily been disposed of. There has also been a large forward business done in London, November-December delivery, at £10 17s. 6d. per ton, and January-March at £11 2s. 6d., Beckton terms; and a further advance of 2s. 6d. per ton is now required. In Scotland nothing important has transpired. The nominal quotation is £11 5s. per ton, ordinary terms, January-June delivery; but it is doubtful whether any large quantity would be sold at this price.

Nitrate of Soda is steady at 9s. 3d. to 9s. 4½d. per cwt., according to quality.

LONDON, *Nov.* 9.

Tar Products.—The demand for pitch continues very strong, especially for prompt delivery; but it is very difficult to obtain supplies for early shipment. Business in South Wales is still very good, but the demand is scarcely so strong forward owing to the uncertainty as

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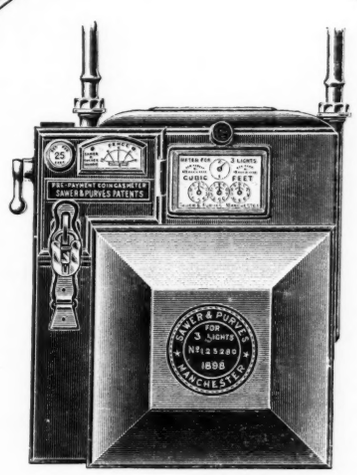

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regards the coal trade. In benzol business has been done in 90 per cent. at 10d. prompt. The demand for this quality seems rather better. On the other hand, 50-90 per cent. is neglected, and consumers will not pay more than 9d. for early delivery. In crude carbolic a very large business indeed has been done for both prompt and forward delivery. Some contracts having been made in 60's at 1s. 11d. all over next year, makers as a rule now ask 2s. in any position. This sudden rise is rather difficult to understand when the very dull state of the market for crystals is considered. A sale of 75's is reported at 2s. 4d. per gallon, January-June, which is at present the highest price realized. Creosote continues to improve in value, and the demand is decidedly increasing. The whole tone of the market is very much better in the North, and a good demand is looked for forward. Anthracene continues in the same unhappy position. There is an entire absence of demand; and it is difficult to see what can be done with "B" qualities, of which there are heavy stocks. Tar remains in the same position; and there is nothing fresh to note. Prices are, however, fairly well maintained all round.

The average values obtaining during the week are: Tar, 14s. 6d. to 17s. 6d. Pitch, east coast, 33s. 6d. to 34s.; London, 35s.; west coast, 32s. to 32s. 6d. Benzol, 90's, 9½d. to 10d.; 50's, 9d. to 9¼d. Toluol, 10d. Crude naphtha, 4¼d.; solvent naphtha, 11d. to 11½d.; heavy naphtha, 10d. to 11d. Creosote, London, 1⅜d.; North, 1d. to 1⅛d. Heavy oils, 2⅛d. to 2⅜d. Carbolic acid, 60's, 1s. 11d. Naphthalene, 60s. to 80s.; salts, 35s. to 45s. Anthracene, "A," 2d. to 2¼d.; "B," unsaleable.

Sulphate of Ammonia.—The market is firm, and a very good business is being done. The Gaslight and Coke Company have advanced their price to £11 for November-December, while they ask £11 5s. for January-June. The demand at Leith is very good. Business has been done at £10 18s. 9d., and several orders at £10 17s. 6d. have been declined by the large makers, who ask, as a rule, £11 in any position for this year. Business has been done in Hull at £10 16s. 3d. for prompt delivery, but makers ask £10 17s. 6d. to £10 18s. 9d. for December shipment. The demand continues good at Liverpool; and prices rule very high compared with Hull.

COAL TRADE REPORTS.

Lancashire Coal Trade.—The colder weather has brought forward an increased inquiry for house-fire coals; while the lower descriptions of round coal have also been in better demand, especially for shipment. The disorganization of the mineral traffic over the railways during the greater part of the week, owing to the fog, has, however, considerably hampered collieries in making deliveries; and the accumulation of loaded waggons at the sidings on this account has necessitated partial stoppages of pits until these could be cleared away. For the better qualities of round coal, there is a fairly brisk demand; and prices are firm at about 15s. per ton at the pit for best Wigan Arley, 13s. to 13s. 6d. for Pemberton four-feet and seconds Arley, and 11s. to 11s. 6d. for common house coal. But the opinion is still prevalent that any appreciable upward move during the winter is improbable, unless some very exceptional conditions should arise. Common round coals are in tolerably good request for steam and forge purposes; and with larger quantities now going away for gas making, collieries have necessarily a lessened weight to offer. At the pit, steam and forge coals are maintained at about 8s. 6d. to 9s. per ton. The position in the engine fuel trade remains very unsatisfactory; and with the continued depression in the cotton manufacturing industry, the prospect is not encouraging. Supplies are plentiful on the market, with the lower qualities a drag; and there is so much surplus offering from other districts for clearance at low-cut prices, that the position generally is weakening. The better qualities of Lancashire slack are fairly steady, at about 7s. per ton, up to 7s. 6d. for some special sorts; but there is an easing tendency in the common kinds, which are obtainable from as low as 4s. 9d. to 5s. 3d. per ton at the pit. Derbyshire slack, which is the chief competitor in this market, is offered at from 2s. 6d. to 3s. per ton at the pit. The shipping trade is fairly active, with good ordinary steam coals generally fetching about 10s. 3d. to 10s. 6d. per ton, delivered at the Mersey ports; but slack is still being offered very low in some cases, where collieries are anxious to clear off special lots under load. A satisfactory demand comes forward for Lancashire coke; and prices are well maintained at about 23s. per ton for good foundry, and 14s. to 15s. for good washed furnace sorts, at the ovens.

Northern Coal Trade.—The coal trade has been much interrupted during the last week by foggy weather, which delayed the collier steamers, and thus laid one or two pits idle. Best Northumbrian steam coals were in consequence rather lower at 11s. to 11s. 3d. per ton f.o.b., steam smalls steady at 6s., and unscreened steams at about 9s. In Durham coals the demand is rather better relatively. Manufacturing coals are plentiful, and may be said to be easier in price, without being actually lower. In the gas coal trade the demand is full, as usual at this time of the year; but the collieries are producing fair quantities, and the contracts are thus well kept up. There is, however, not much for sale beyond these. Prices of Durham gas coals for occasional cargoes vary from 12s. to 12s. 6d. per ton f.o.b., according to quality. The coke trade is generally firm; best Durham coke for export being 18s. to 18s. 6d. per ton f.o.b., and blast-furnace coke 16s. 9d. to 17s. at the furnaces on Tees-side. Gas coke is steady at about 13s. per ton f.o.b.; the production being now very large, with slight increases in the stocks in some of the inland centres.

Scotch Coal Trade.—The trade is still from day to day. Scotch coal is relatively the dearest in the market; and consequently forward orders are scarce. There is little change in prices, which may be quoted: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 9d. to 11s. The shipments for the week amounted to 214,841 tons—an increase of 40 tons upon the preceding week, but a decrease of 11,311 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,373,632 tons—a decrease of 997,030 tons upon the same period of last year.

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Gas-Works Matters at Leeds.—In connection with the installation of carburetted water-gas plant at the Meadow Lane Gas-Works of the Leeds Corporation, the Gas Committee last Saturday recommended the acceptance of a tender for new buildings amounting to £2323, which is to be paid out of the reserve fund. Another matter of interest is that it is intended by the Corporation to obtain from the Local Government Board a Provisional Order for an amendment of statutory provisions, so as to enable the Corporation to use for the manufacture or storage of gas or residual products a plot of land, containing 6293 square yards, adjoining the Meadow Lane works.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. D. Burnett and Co. sold some "A" shares, of £20 each, in the Colchester Gas Company, at £45 6s. 8d. apiece, and "B" shares, of like nominal amount, at £30 each; some £10 ordinary 7 per cent. shares in the Bromley Gas Consumers' Company, at £18 13s. 4d each; and a parcel of 4½ per cent. preference stock of the Sutton District Water Company, at a premium of 31 per cent. Last Thursday, 56 shares in the Coupar Angus Gas Company were sold at from £5 14s. 6d. to £5 16s. 6d. apiece. A few £10 shares in the Dover Gas Company, carrying a dividend of 7½ per cent., have been sold by auction at £15 2s. 6d. each.

Shop Window Lighting in Germany.—The Berlin police authorities have lately published a long notice to shopkeepers about the dangers involved in the lighting of gas-burners in shop windows by means of naked flames. The notice states that, unless the windows are completely isolated (from the fire insurance point of view) from the rest of the building, this method of igniting the gas must be abandoned within eight days of receiving the notice, under a penalty of 100 marks or "ten days." No special process of lighting the burners is stipulated or recommended; but presumably either self-igniting devices or electrical appliances are to be used. The Munich Magistrates have issued a similar ordinance, which, moreover, forbids the hanging of inflammable goods on gas-brackets, either in the windows or in the shop itself.

Threatened Strike at the Colne Gas-Works.—A curious paragraph appeared in some of Thursday's provincial papers. It read: "The gas workers of Colne have applied to the Colne Town Council for an increase of wages from 22s. to 25s. a week; and the Council have refused to accede to the demand. A strike is imminent unless a compromise be at once effected, and pressure is to be brought to bear on the Corporation to change their decision, failing which the town will be plunged into darkness at an early date. The gas workers are well organized." It is extremely kind of the gas workers to give an early intimation of their intention to "plunge" the town into darkness, as in these days it does not take many hours to make provision for preventing such an occurrence. But this is the sort of brag which Unionist leaders are fond of making use of, with the object of pleasing the workmen and frightening those from whom they wish to get concessions. Such talk may go down with the men; but it does not frighten a strong company or local authority.

Leakage in a Reservoir.—The Morley Corporation appear to be unfortunate with their Victoria service reservoir at Bruntcliffe. Some time ago, it was found to be defective; and £8000 was spent in reconstructing it. The work was completed at the end of last year. Leakage has again been observed; and it is believed to have been located. If this fortunately proves true, it is hoped that the cost of repairing the defect will not be heavy.

A New Water Scheme for Earlestown and Newton.—The Newton-in-Makerfield Urban District Council are now undertaking a scheme for the erection of additional water-works plant for the adequate supply of Earlestown and Newton. The Council have applied to the Local Government Board for sanction to borrow £20,700, in order to carry out the works. It is intended to sink a well 11 ft. by 6 ft., and 200 ft. deep, and the estimated cost of it will be £1200; 600 feet of tunnelling, at a cost of £1500; erection of a duplicate pumping-engine, £1890; engine-house addition, £300; travelling crane, £140; a cottage, £400; and contingencies £570—making a total of £6000. It is also proposed to construct a service reservoir to hold about 500,000 gallons of water, the cost of which is estimated at £470; an elevated tank, £1600; and another cottage at a cost of £400; and to lay new distribution mains at a cost of £8000—the whole scheme being estimated to cost £20,700. The estimates were prepared by the late Engineer to the Council; but the new Engineers (Messrs. Read and Waring) have revised the figures, and calculate that £9700 is required for the laying of the new distribution mains, instead of £8000; this being caused by an error in the length of pipes required to be laid from the water to the service reservoir. The application to the Local Government Board was the subject of an inquiry by Colonel W. Langton Coke last Wednesday.

Proposed Softening of Barry Water.—At the meeting of the Gas and Water Committee of the Barry Urban District Council on Monday last week, a report was presented by the Water Engineer (Mr. E. W. Waite) on the question of the advisability of softening the water supplied to the district (it being at present very hard) by the same process as that in operation at Southampton. The estimated cost was stated to be ¾d. per 1000 gallons. The Clerk (Mr. J. A. Hughes) called attention to the fact that there was already a heavy loss on the Water Department; the water being sold at 9d. per 1000 gallons, while it should, in order to pay them, be charged at 1s. The Council had, however, reached the maximum amount they were permitted to demand. Alderman Meggitt asked what would be the approximate saving to the consumers. Mr. Waite replied that he had estimated it to be 5s. per annum per head of the population. Alderman Meggitt claimed that even if it caused one-fifth of this amount of saving, it would be an indirect benefit to the people of the town. The rates would be the only thing to suffer directly by the adoption of some such process. He moved that the report be printed and circulated among members of the Council, and that prior to another meeting being held to consider the matter the Chairman (Mr. Paterson) and Mr. Manaton, with the Engineer, should visit Southampton, and report upon the process.

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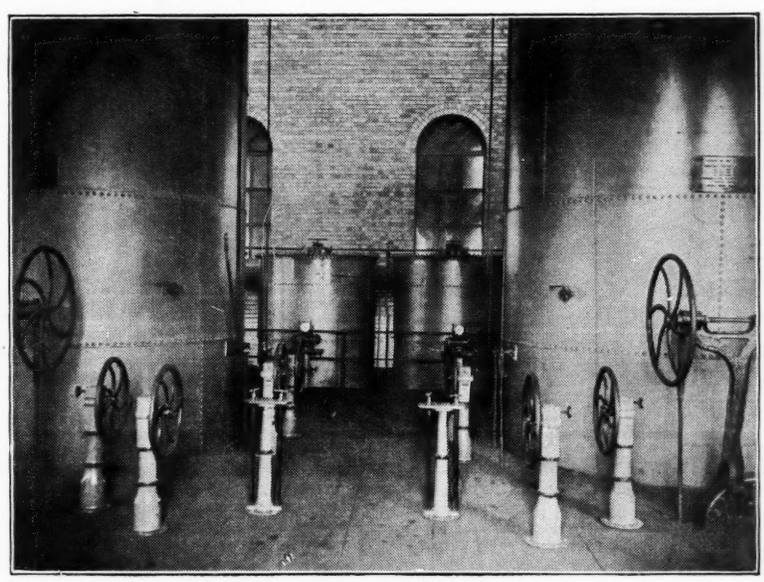

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The New Gas-Works for Slough.—Our readers are aware that the contract for the erection of new works for the Slough Gas Company has been secured by Messrs. R. & J. Dempster, Limited, of Manchester. They will cost something like £16,000; and at an extraordinary meeting of the shareholders recently held, the Directors were authorized to issue new share and debentures to the extent of £20,000.

Carlisle Gas and Water Managership.—At a special meeting of the Carlisle Town Council last Tuesday, the Chairman of the Gas and Water Committee (Mr. Corbett) stated that, as Mr. Newton had left, they were now without an Engineer. Temporary arrangements had been made for carrying on the gas and water works, and the Committee would hold a meeting at an early date to take into consideration the question of appointing a successor, and of the future management of the two undertakings.

Proposed Purchase of the Abercarn Gas and Water Works.—Last Tuesday, a statutory meeting of the Abercarn District Council was held to consider the proposed purchase of the Abercarn and Newbridge Gas and Water Company's undertaking. The Directors sent a letter to the meeting, intimating that they were not in favour of being bought out. Mr. W. Thomas proposed that a special meeting of the Council be held to consider the report of the electrical engineer, and that the question of purchasing the gas-works be deferred. This having been seconded, Mr. G. Barker moved, as an amendment, that a meeting of ratepayers be called to decide as to the promotion of a Bill in the next session of Parliament for the purchase of the Gas and Water Company's works. On it being put to the vote, nine voted for the amendment and four for the motion. As, however, the Clerk pointed out that the resolution must be carried by a clear majority of the Council, one member who had voted with the minority transferred his vote to the other side; and the amendment was then declared carried by ten votes to three.

Price of Gas and Stokers' Wages at Stockton.—At the meeting of the Stockton Corporation last Tuesday, Mr. A. Smith moved that the Gas Committee should consider the question of a reduction in the price of gas. Mr. Barrowcliff seconded, and thought coke should also be reduced. The Mayor (Alderman R. Hind, J.P.) pointed out that, while the price paid for coal was formerly 8s. 3d. per ton, with the exception of the last three months it had been 18s. 2d. and 18s. 3d. Therefore they were very moderate indeed to only increase the price of gas 6d. per 1000 cubic feet. In their estimates, the Corporation calculated upon so much profit from the gas-works; and if they reduced the price, they would not have the profit upon which the reduced rates were based. The consequence would be that the rates would have to be increased next year. They had also to provide for the extra cost of increasing the wages of the stokers. The motion of Mr. Smith was lost; only five voting for it. In connection with the increased cost of stokers' wages, it is stated that the men have asked for a rise of 2s. 6d. a week, but that an offer has been made to them which it is expected will be accepted. The matter will, however, have to come formally before the Gas Committee.

Proposed Purchase of the Omagh Gas-Works.—At the meeting of the Omagh Urban District Council on Monday of last week, it was decided, on the motion of the Chairman (Mr. M. Lynch, J.P.), to promote in the next session of Parliament a Bill to sanction the purchase of the undertaking of the Omagh Gas Company.

Opening of London Roads.—At the meeting of the Westminster City Council last Thursday, some discussion took place on a communication received from the London County Council, asking whether the Westminster Council would be prepared to support them in making a representation to the Government as to the necessity for legislation to confer upon the London County Council powers to make bye-laws or regulations regarding the manner in which companies and others having statutory rights to break open the public thoroughfares should exercise such rights; also to compel the companies to move their pipes or wires into any subways constructed by the Council. Mr. G. W. Smith moved to revoke so much of the resolution of the Westminster Council, passed on the 24th ult., relating to the control of the breaking-up of the streets by various companies, which provided as follows: "The City Council will be prepared to have the central authority, the London County Council, constituted as the body to appeal to in cases of dispute between the local authorities and any of the companies." After some debate, the motion was agreed to; and it was resolved that, in lieu of the County Council, the Board of Trade should be constituted the appeal authority in cases of dispute between the Metropolitan Borough Councils and any of the companies.

Anglo-Belgian Welsbach Incandescent Gas-Light Company, Limited.—At the third ordinary general meeting of this Company last Wednesday, the Chairman (Mr. G. E. N. Ryan) explained that the main cause of the falling off in the net profit was the further reduction which it had been necessary to make in the price of mantles and burners. The Directors little thought a year ago, having already considerably lowered the price, that it would be imperative to again reduce them so soon. Competition had gone on increasing rapidly in Belgium, as well as in England; and, in addition, the Company had been put to great expense in endeavouring to stop infringements of their patents. Should still further reductions have to be made, it was to be hoped that there would be a corresponding growth in the sales. The position of the Portugese Company had also largely contributed to the unsatisfactory result of the year's operations. The Company began the year with fewer liabilities; and he saw no reason why, with good management in Belgium, the profit should not suffice to pay the preference dividend and also a dividend on the ordinary shares. In conclusion, he moved the adoption of the report. Mr. Ehrenbacher contended that the expenses were too large, and said that, in his opinion, the Directors should abandon legal proceedings against infringers of the Company's patents, and conduct the business on a commercial basis. Mr. Marshall Jay (a Director) remarked that this was largely the present view of the Board. M. Emile Sepulchre (Managing-Director) gave particulars of the expenditure in Belgium, and referred to the competition the Company had to contend with. The report was adopted.

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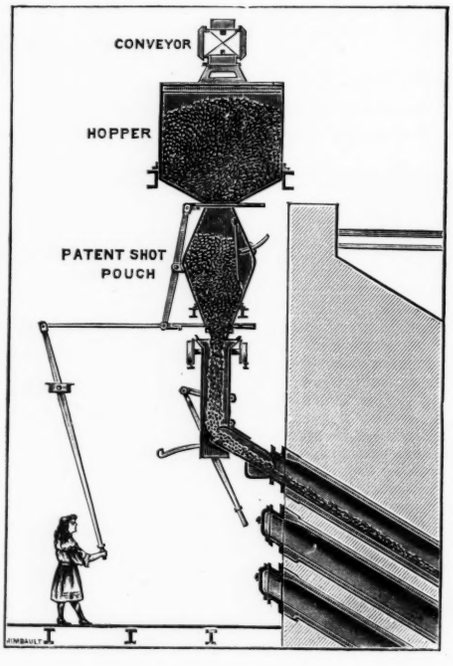

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Tenders will be opened on the 27th inst. in the office of the Municipality of the town of Paterna, in the Province of Valencia, for the execution of the works, according to the estimates and plans which are now on view, for bringing a supply of drinking water to the town, from the source known as "La Fuente."

The Barcelona Municipality, according to the "Revista Minera," have had under consideration lately the question of constructing municipal gas-works, and have been discussing the relative merits of the different processes of water-gas manufacture. Their attention has, it is stated, been specially directed to the Dellwik-Fleischer system.

At the last meeting of the Lincoln Town Council, it was announced that the Gas Committee had decided that when the electric light had been cut off on account of non-payment of rent, no gas should be supplied without a deposit; and that for gas-meters retained on premises after being thrown out of use, a charge of 10 per cent. on the cost of the meter would be made.

It will be seen from a paragraph in our "Electric Lighting Notes" that the Exeter Town Council have accepted the tender of the British Westinghouse Company for their new electric lighting installation. It will be put up on a site adjoining the premises of Messrs. Willey and Co., who, in alliance with the Company, have secured about £10,000 worth of structural ironwork, and the duty of erecting a great deal of the plant, steam-boilers, the manufacture and erection of the coal hoppers, and elevators, &c.

The annual dinner of the employees of the Davis Gas-Stove Company was held on the 26th ult., at the Great Eastern Hotel, Liverpool Street. The large hall was filled with the men and the officials and staffs of the various departments. Mr. H. J. Davis was in the chair, and Mr. H. Addis Price in the vice-chair. The dinner was on a generous scale; and the enjoyment of those present was in full proportion. A few toasts were honoured; the principal one, "The Davis Gas-Stove Company," being submitted by Mr. F. H. Porter. To this Mr. C. W. Davis responded. A programme of music and song occupied the remainder of the evening.

Gas engineers and managers should have no difficulty in equipping their works with suitable elevating and conveying machinery. Among the firms competing for their patronage is that of Messrs. Blake, Barclay, and Co., of the Victoria Works, Greenock and London, who have just issued a new illustrated catalogue of their various labour-saving appliances for the transport of materials. It is divided into three sections, occupying 70 pages; but it is the second, dealing specially with the handling of coal and coke in gas-works, with which our readers will be mainly concerned. In addition to some well-executed reproductions of photographs of the plant produced by the firm, sections are given of retort-houses on the inclined and horizontal systems. The catalogue is altogether well got up.

It will not be out of place here to direct attention to the advertisement supplement issued with this week's "JOURNAL" by Messrs. John Wright and Co., of Birmingham, in which they outline a slot-meter installation scheme, the details of which had been completed, and the idea introduced, by the firm last spring. We mention this as there appears to be little doubt that whatever credit there may be attaching to this project is the due of Messrs. John Wright and Co., and that they may distinctly claim to be the originators. It is a departure in the economics of gas-works management which is new and ingenious, and affords another channel through which gas suppliers may, in some cases, cheaply develop business. We say "in some cases," because this is essentially a scheme in which the circumstances of the gas suppliers and local conditions must determine whether or not it will be more to their advantage to adopt the scheme, or to prosecute the development of the business on their own account. The rate at which capital can be raised by gas suppliers, and the point as to whether it is good policy to be tied to one firm (whether it be a good old-established firm like Messrs. John Wright and Co. or any other) in this particularly promising field for development, are questions that must be considered in each individual instance before coming to a decision. Without the full details before us, we cannot examine into the latter point; but we conceive that it would be one of the conditions of the agreement that the contracting "installers" would have a monopoly of the district at any rate for a certain number of years, in order to make the exploitation worth their while. On the other hand, it would not be difficult to put a finger on towns where the gas undertakers would find it a tremendous gain to take advantage of this scheme from the capital point of view, and others again who would benefit to a not inconsiderable extent by handing over the work of pushing their business in this direction to an enterprising firm like Messrs. John Wright and Co. The published outline of the scheme shows that the firm are willing to make a strong effort to secure fresh consumers under the slot system, and supply and maintain installations. The consumers are to pay the cost out of the excess charge collected from them for gas, and the installation at the end of a given period will become the absolute property of the gas suppliers without any payment on their part. Of course, the slot consumers under this scheme must not be allowed to obtain knowledge of this little arrangement, or the more cute among them may want to know why, at the end of the specified period, they, who have paid the cost, should not be permitted to enjoy the "absolute property" in the installation instead of the party who takes possession without having expended a penny piece. But joking apart, it is impossible to express an opinion which would have general applicability in regard to a matter of this kind. Each gas supplier must look at it from his own point of view, and his circumstances will largely guide him in coming to a decision. We shall watch the scheme with interest, and shall be glad to receive, as time goes on, information in regard to any successes which may be achieved under it.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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BY the adoption of Cripps's Bye-Pass VALVES inside your Purifiers, you can relieve the Back-Pressure in the Lower Tiers when the Purifying Material gets hard. They are extremely useful and economical.
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WANTED, Appointment as Inspector of Meters, Main and Service Layers, Gas-Fitters and their Work, and Incandescent Lighting for Domestic and Public Uses. The Advertiser has had large practical experience (Home and Foreign), and is willing to make himself generally useful in any Department on a Gas-Works. Satisfactory References.
Address No. 3766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED a Working Gas Manager for Small Works.
Apply to W. ROSE, CLEOBURY MORTIMER.

GAS-METER Testers, both Wet and Dry, wanted.
Apply to the SUTHERLAND GAS-METER COMPANY, Essex Works, Aston, BIRMINGHAM.

WANTED, a Gas-Fitter (temporary) for a few months. Accustomed to all Branches and Service Laying.
Further Particulars from the MANAGER, Gas Company, Halesowen, near BIRMINGHAM.

WANTED, a Man to set Retorts and do general Bricklaying at Works near Birmingham. Must be used to Regenerative Settings. Permanent Situation to suitable Man.
State Age, Experience, Wages required, &c., to No. 3753, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Gas-Works in the West of England, with an annual make of 3 to 4 millions, a well-educated WORKING MANAGER, House, Coal, and Gas free.
Apply, by letter, stating Age, Qualifications, and Salary required, to 13,801, Haddon's Advertising Offices, SALISBURY SQUARE, E.C.

YOUNG Working Manager Wanted for the Gas-Works at Hungerford. Small, but increasing, make. House, Gas, and Coal free. Applicant must have had Technical Training.
Reply by letter, stating Age, Qualifications, and Salary required, to the SECRETARY, Hungerford Gas Company, Ltd., 50, CANNON STREET, E.C.

WANTED, for a Gas-Works abroad, a smart, single Young Man as FITTER. Must be well up in all kinds of Internal and External Fitting Work, including Gas Cookers, Meters, and Incandescent Lighting.
State Wages required, and where last employed, to No. 3775, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an energetic Young Man to take charge of, and manage under general supervision of Manager, Coke-Ovens where Bye-products are collected. Applicant will be required to make waste liquor and other Tests, and to have a knowledge of Gas Manufacture. Wages to commence 30s. per week.
Address No. 3773, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an energetic Foreman Mechanic for a large Gas-Works in the South of England to take control of Fitters, Turner, and Blacksmiths, with Labourers, numbering about 20 men. Must have a thorough knowledge of Compressed-Air Stoking Machinery, High-Speed Steam-Engines, Gas-Engines, Pumps, Boilers, Gas Exhausters, and the general Appliances used on a Gas-Works. Wages 40s. per week, with House and Garden only. Age 30 to 40. First-Class References required.
Apply, not later than Nov. 30, to No. 3774, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SUPERINTENDENT.

THE Reading Gas Company require the services of an OUTDOOR SUPERINTENDENT. He must be well experienced in Main Laying, Service Work, Fittings in all branches, Prepayment System of supplying Gas, and be competent to control the Workmen engaged in the above Department.
Applications, with *copies* of three recent Testimonials enclosed, and stating Age, previous Experience, and Salary required, to be sent to the undersigned (from whom any further Particulars may be obtained) on or before Nov. 27, 1901.
HERBERT E. S BAKER,
Engineer and Manager.
Gas-Works, Reading.

DEVONPORT WATER-WORKS.

ASSISTANT ENGINEER.

THE Directors invite Applications for the above APPOINTMENT. Candidates must have had experience in a Water-Works Undertaking and in Main Laying. Must be accurate Surveyors, expert at Levelling, and good Draughtsmen, and have a general knowledge of Water-Works.
Salary £150 per annum, increasing £10 a year to a maximum of £200.
Candidates must not be more than 35 years of age.
Applications, accompanied by not more than three Testimonials, endorsed "Assistant Engineer," should be sent to the undersigned not later than Ten a.m., on Wednesday, the 20th of November next.
H. FRANCIS,
Engineer and Manager.
Water-Works Offices, Devonport,
Oct. 24, 1901.

WATER-WORKS.

WANTED, in North of England, an experienced man competent to make SURVEYS and PREPARE PLANS for a New Pumping-Station and Service Reservoir, and to act as CLERK OF WORKS during their construction. Wages 3½ Guineas per week. Must have had previous experience in same class of Work.
Apply, by letter, stating Age, full Particulars of Experience, and sending *copies* of not more than three recent Testimonials, to No. 3771, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PURIFIERS.

WANTED, Second-Hand, Two Purifiers, about 30 to 36 superficial square feet area each, and Connections.
WILLIAM KEY.
109, Hope Street, Glasgow.

WANTED, a Second-Hand Cast Iron TANK, suitable for storing Ammoniacal Liquor, Capacity not less than 250,000 gallons. State Particulars and Price delivered at our Siding to
R. BROWN,
Engineer and Manager.
Gas-Works, Camb.idge.

GOVERNOR, 10-inch Peebles, replaced by a larger one, FOR SALE.
Apply to FORBES WADDELL, BROUGHTY FERRY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—Thirty six Columns and WROUGHT-IRON SCROLLS. Weight 6 cwt. each. Price 30/- each to clear the lot, or 35s. each for smaller quantities.
Apply to H. WIMHURST, Gas-Works, SLEAFORD.

FOR SALE.—400 light Dry Gas-Meter, made by Messrs. Glover and Co., London. In splendid condition.
Apply to the GILLROYD MILLS COMPANY, LTD., Morley, near LEEDS.

TO BE SOLD—
GASHOLDER (and Cast-Iron Tank), 17,500 cubic feet capacity.
CENTRE-VALVE, 15 in. diameter, by Walker, for Four Purifiers.
Four PURIFIERS, 10 feet square, in line, with Planed Joints, Walker Centre-Valve, Covers, and Traversing Crab Lifting Gear. Will be refixed equal to new.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

J. FIRTH BLAKELEY & CO., Thornhill, Dewsbury, have FOR SALE cheap—
ANNULAR CONDENSERS up to 16-in. Connections.
EXHAUSTERS and ENGINES up to 60,000 feet per hour.
"HOLMES" and "CLAPHAM" WASHERS and TOWER-SCRUBBERS.
GASHOLDERS, 15 ft., 25 ft., 30 ft., and 50 ft. diam.
PURIFIERS, sets of 6 ft., 8 ft., 10 ft., 12 ft., and 20 ft. square.
J. F. B. & Co., are the largest Buyers and Dealers in SECOND-HAND GAS PLANT, and have an extensive Stock. Inquiries solicited from both Vendors and Purchasers of the same.

SCARBOROUGH GAS COMPANY.

SALE BY TENDER OF MORTGAGES BEARING INTEREST AT £4 PER CENT. PER ANNUM.

PURSUANT TO SECTION 21 OF THE SCARBOROUGH GAS ACT, 1895.

NOTICE is Hereby Given, that the Directors of the Scarborough Gas Company intend to SELL, by TENDER, MORTGAGES to the amount of £8000 for the general purposes of the Undertaking.
The Mortgages will be granted under and by virtue of the Scarborough Gas Act, 1895. They will be issued for amounts of £100 each, and will bear Interest at the rate of £4 per cent. per annum, payable half-yearly, and the principal moneys secured thereby will be repayable on the 31st day of December, 1921.
The existing paid-up Share Capital of the Company is £199,472, and the Loan Capital consists of Mortgages to the amount of £47,750, bearing Interest at the rate of £3½ per cent. per annum.
The Mortgages to be now issued will rank before the whole of the Company's existing and authorized Share Capital, and the Interest thereon will have priority of payment over all Dividends on such Share Capital, and will rank equally with the Interest on all Mortgages and Debenture Stock of the Company.
Maximum Dividends have been paid on the Share Capital since 1872, thus showing the ample security for the payment of Interest on these Mortgages.
Tenders must be sent in to the Company's Office, 32, Westborough, Scarborough, not later than Twelve o'clock noon on Saturday, the 30th day of November, 1901, but no Tender will be accepted at a lower price than £100 for each Mortgage, and every purchaser must pay the whole of his purchase money on or before Wednesday, the 1st day of January, 1902.
Copies of the Company's Special Acts may be seen at the Company's Offices, where Particulars and Forms of Tender may be obtained on application.
By order of the Directors,
ALEXANDER ALLAN,
Secretary.
Scarborough Gas Company's Offices,
32, Westborough, Scarborough,
Nov. 1, 1901.

THE Bridgewater Trustees are prepared to receive TENDERS for the TAR produced at their Coke-Works for a period of Six or Twelve Months, from the 1st of January next, delivered into Contractor's Tanks at the Trustees' Brackley Siding on the Little Hulton Mineral Branch of the L. & N.W. Railway; or their Wharton Hall Siding on the Pendleton and Hindley Branch of the L. & Y. Railway.
Tenders, endorsed "Tender for Tar," to be addressed to the Bridgewater Trustees, 4, Chapel Walks, Manchester, and to be delivered on or before the 30th of November.

BOROUGH OF ROCHDALE.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of 15,000 gallons of BENZOL for delivery over the ensuing Four Months.
Forms of Tender may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works, Dane Street.
Tenders, endorsed "Benzol," must be sent in to me not later than noon on Wednesday, Nov. 20, 1901.
By order,
JAMES LEACH, Town Clerk.
Town Hall, Rochdale,
Nov. 9, 1901.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 5th inst.,
THOMAS HENRY GOODWIN NEWTON, Esq., in the Chair, when the following RESOLUTIONS were unanimously passed:—
"That the Report of the Directors upon the affairs of the Association be received, adopted, and entered upon the Minutes."
"That a Dividend of 5 per cent. for the Half Year ended the 30th of June last be declared upon the £3,800,000 Capital Stock of the Association, and that the same be payable, free of Income-Tax, on and after the 12th of November inst."
Cordial Votes of Thanks were passed to the Directors for their able management of the affairs of the Association, to the Chairman for his conduct in the Chair, and to the Staff in London and on the Continent.
By order of the Board,
ROBERT W. WILSON,
Secretary.
21, Austin Friars, London, E.C.,
Nov. 6, 1901.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that The Hesperus Acetylene Gas Lighting Syndicate, Limited, of Worcester House, Walbrook, in the City and County of London, have APPLIED FOR LEAVE TO AMEND THE SPECIFICATION OF LETTERS PATENT No. 4195 of 1900, granted to Wilhelm Widmann, for an improved Calcium Carbide Admission Valve for use with Acetylene Gas Generators.
Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)" issued on the 6th of November, 1901.
Any person, or persons, may give Notice of Opposition to the Amendment (on Form G) at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."
C. N. DALTON,
Comptroller-General.
Agent for Applicant:
JOHN P. O'DONNELL, M. Inst., C.E.,
Palace Chambers, Westminster.

ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an EXTRAORDINARY GENERAL MEETING of the Oriental Gas Company, Limited, will be held at the Offices of the Company, Finsbury House, Blomfield Street, in the City of London, on Wednesday, the 20th day of November, 1901, at Twelve o'clock noon, precisely, when the subjoined Resolution, which was passed at the Extraordinary Meeting of the Company, held on Wednesday, the 23rd day of October, 1901, will be submitted for confirmation as a Special Resolution:—
"That the Capital of the Company be reduced by reducing the amount of each of the 30,000 Shares of £5 each, on each of which Shares the sum of £4 10s. has been paid, to a Share of £4 10s. fully-paid, and cancelling the uncalled Capital of Ten Shillings per Share on such £5 Shares, and by reducing the amount of each of the 15,000 Shares of £5 each, on each of which Shares the sum of £1 has been paid, to a Share of £1 fully-paid, and cancelling the uncalled Capital of £4 per Share on such last above-mentioned £5 Shares."
By order of the Board,
H. J. LUFF, Secretary.
Finsbury House, Blomfield Street,
London, E.C., Nov. 11, 1901.

ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices of the Company, Finsbury House, Blomfield Street, London, E.C., on Wednesday, the 20th day of November, 1901, at Twelve o'clock noon (or as soon thereafter as the business of the Extraordinary General Meeting convened for that day shall be concluded), for the following purposes: To receive the Directors' Report and the Accounts of the Company for the Year ended the 30th of June, 1901, to declare a dividend, and to elect Directors and Auditors in the place of those retiring.
The TRANSFER BOOKS WILL BE CLOSED from the 18th of November to the 4th of December, both days inclusive.
By order of the Board,
H. J. LUFF, Secretary.
Finsbury House, Blomfield Street,
London, E.C., Nov. 11, 1901.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LEA BRIDGE DISTRICT GAS COMPANY.

NEW ISSUE OF £8000 CONSOLIDATED ORDINARY STOCK AND £2560 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS AND WATER COMPANY.

£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND GAS COMPANY.

NEW ISSUE OF £5000 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
PINNER GAS COMPANY, LIMITED.

NEW ISSUE OF 400 £5 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SWANAGE GAS AND WATER COMPANY.

NEW ISSUE OF £10,000 FOUR-AND-A-HALF PER CENT. PREFERENCE STOCK (£5000 being "Water" Preference and £5000 being "Gas" Preference).

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Nov. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 Inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HEATHCOTE GAS COAL.

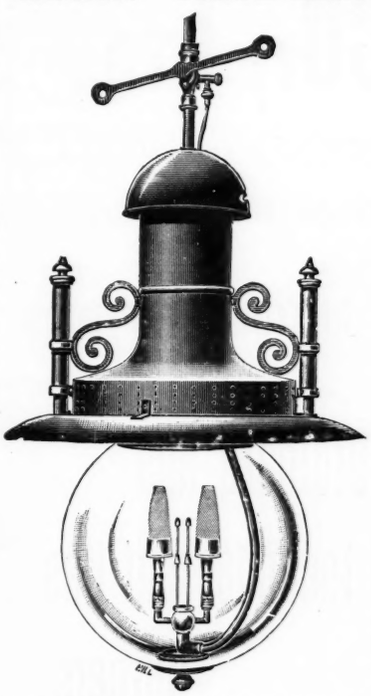
Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

THE PATENT
"BEACON" GLOBE LAMP.



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FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees
GAS DESULPHURIZATION CO.,
— LIMITED, —
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SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
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STEEL OF ALL DESCRIPTIONS.
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE, SON, & HUNTER,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

FALK, STADELMANN, & CO., LIMITED,

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Head Offices: **83 to 87, Farringdon Road, London, E.C.**

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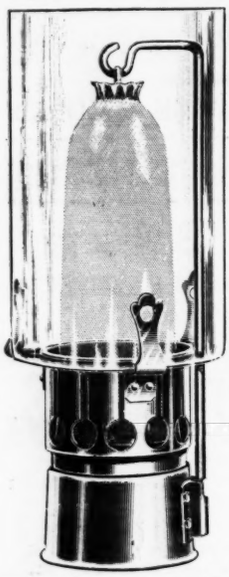
The "KERN" Patent Mantle Protector and Glass Holder.



Particularly recommendable for Street Lanterns where "**Kern**" Burners are used.

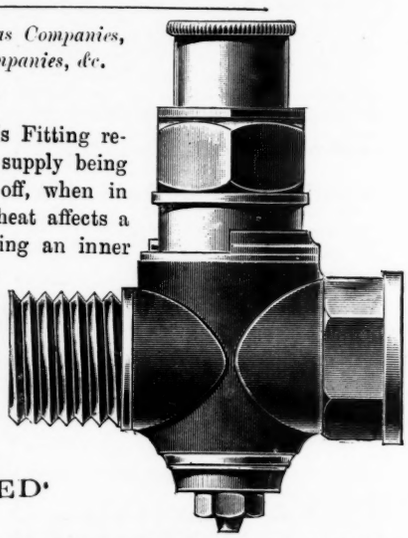
Protection against Draught and Wind.

Holder **encloses fringe of Mantle,** also enables *Mantle* to be *bodily removed* when cleaning Lanterns.

"SALVAGE" Automatic Gas Stopcock.

Invaluable to Gas Companies, Fire Insurance Companies, &c.

The action of this Fitting results in the Gas supply being immediately cut off, when in cases of fire the heat affects a composition holding an inner plug, which composition immediately melts, and allows the plug to automatically close the Tap.



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SURREY WORKS, SMETHWICK.
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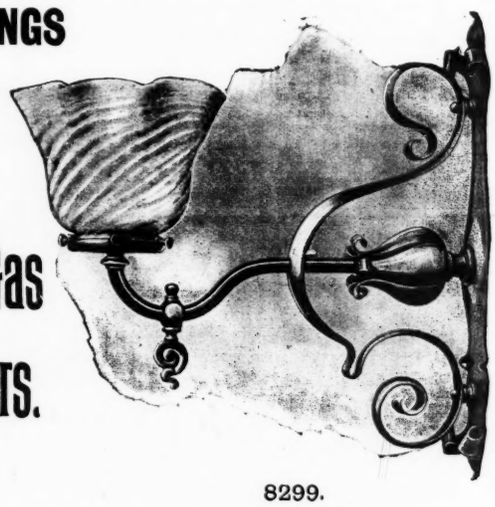
FOR

Ordinary and Incandescent Gas Burners.



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HARDMAN & HOLDEN, Ld.
ESTABLISHED 1820.
SULPHURIC ACID.
MADE from Spent Oxide (free from Arsenic) and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.
Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.
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Inquiries Solicited.

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Manufacturers of
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RETORTS CAREFULLY PACKED FOR SHIPMENT.

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Will be pleased to send Sample Patterns and Prices to the Managers and Engineers of Gas Companies, similar to those which have been supplied by them to the South Metropolitan Gas Co., The Gaslight and Coke Co., Commercial Gas Co., and others, for 30 years past.

ALL KINDS OF STOUT LEATHER GLOVES FOR FURNACE OR SMELTING WORKS MADE TO ORDER.

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GAS ENGINEERS & CONTRACTORS.—CARBONIZING SPECIALISTS.
RETORT SETTINGS & IRONWORK OF EVERY DESCRIPTION.
Inclined & Horizontal Regenerator, Generator, & Direct Fired.
RETORT-HOUSES BUILT AND EQUIPPED COMPLETE.
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ARE UNEQUALLED FOR PRODUCTIVE CAPACITY AND ECONOMY IN FUEL.
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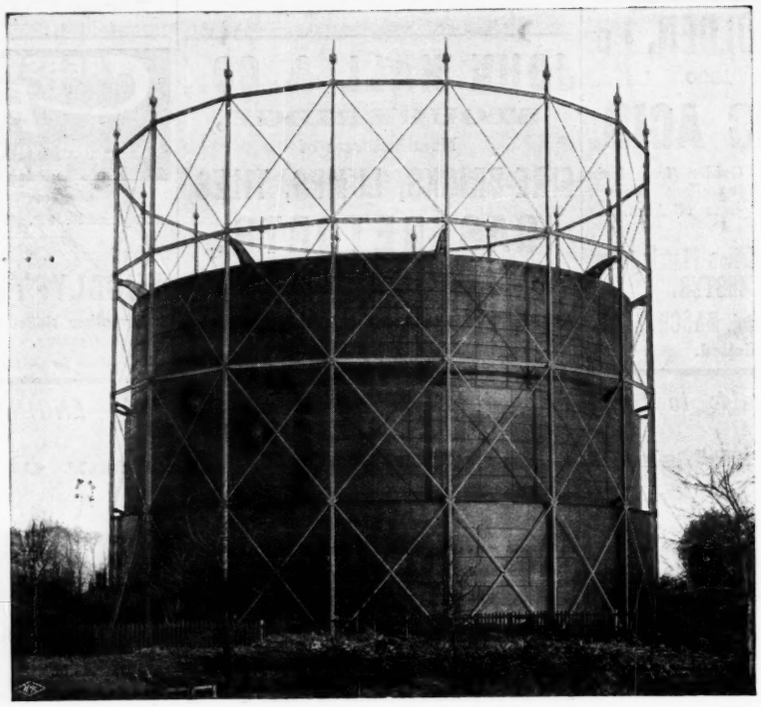
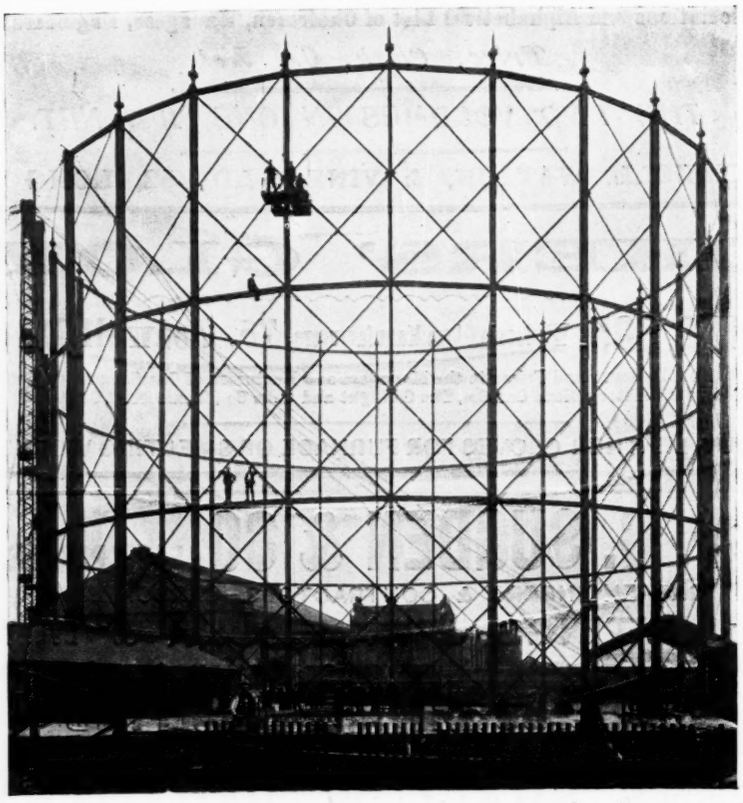


Three Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.



Three-Lift Gasholder, 145 feet diameter by 35 feet deep, in course of construction for the WANDSWORTH & PUTNEY GAS COMPANY.

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CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS

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FLANGE PIPES FOR STEAM.

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IMPORTANT TO GAS COMPANIES & CORPORATIONS.

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ONE SIZE ONLY.

Will take all ordinary Rods, Mantles, and Globes. Being fitted with the Perfect Regulator, it automatically adapts itself to all Pressures and Qualities of Gas, and acts also as a Bye-Pass.

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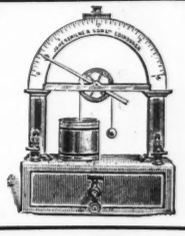

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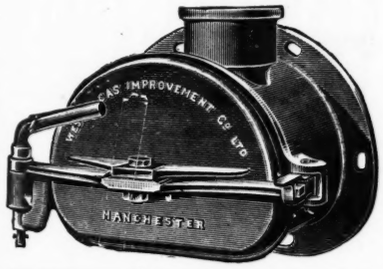

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THESE CONVEYORS ARE NOW WORKING IN ENGLAND

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Half Actual Size.

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HIGH PRESSURE BURNER

Has already been largely adopted by the leading Gas Companies and Corporations.

IT GIVES THE BEST LIGHT.

More Candle Power than any H.P. Burner using 10 ft. per hour.

CAN BE INSTANTLY ADJUSTED to suit the quality of Gas in any District.

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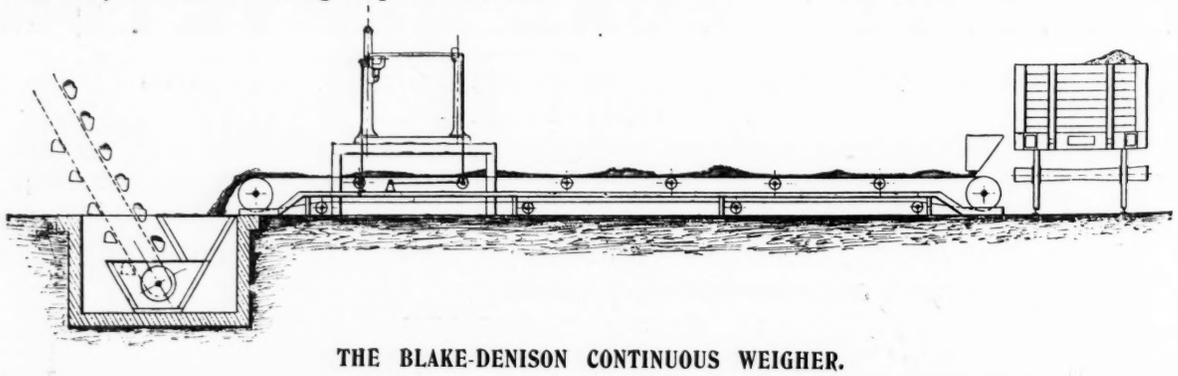

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SELF-INTENSIFYING LAMP.

Automatic Action.

No Complex Mechanism.

"Power" Free of Cost.

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NOW IN USE
AT THE GLASGOW EXHIBITION.

INTENSIFIED LIGHT

WITHOUT Compressing Plant, Special Gas-Service, Water Bill, Gas-Engine or other Pumping Appliances, tearing up of Roadways, or interference with existing Service.

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Lanterns supplied with Single, Duplex, or Cluster of Burners.

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350 to 500 Candles from a Single Burner, with an efficiency of 35 Candles per cubic foot of Gas.

The ONLY High-Pressure Lamp.

THE LAMPS MAY BE INSPECTED AT ANY TIME BY APPOINTMENT.

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For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

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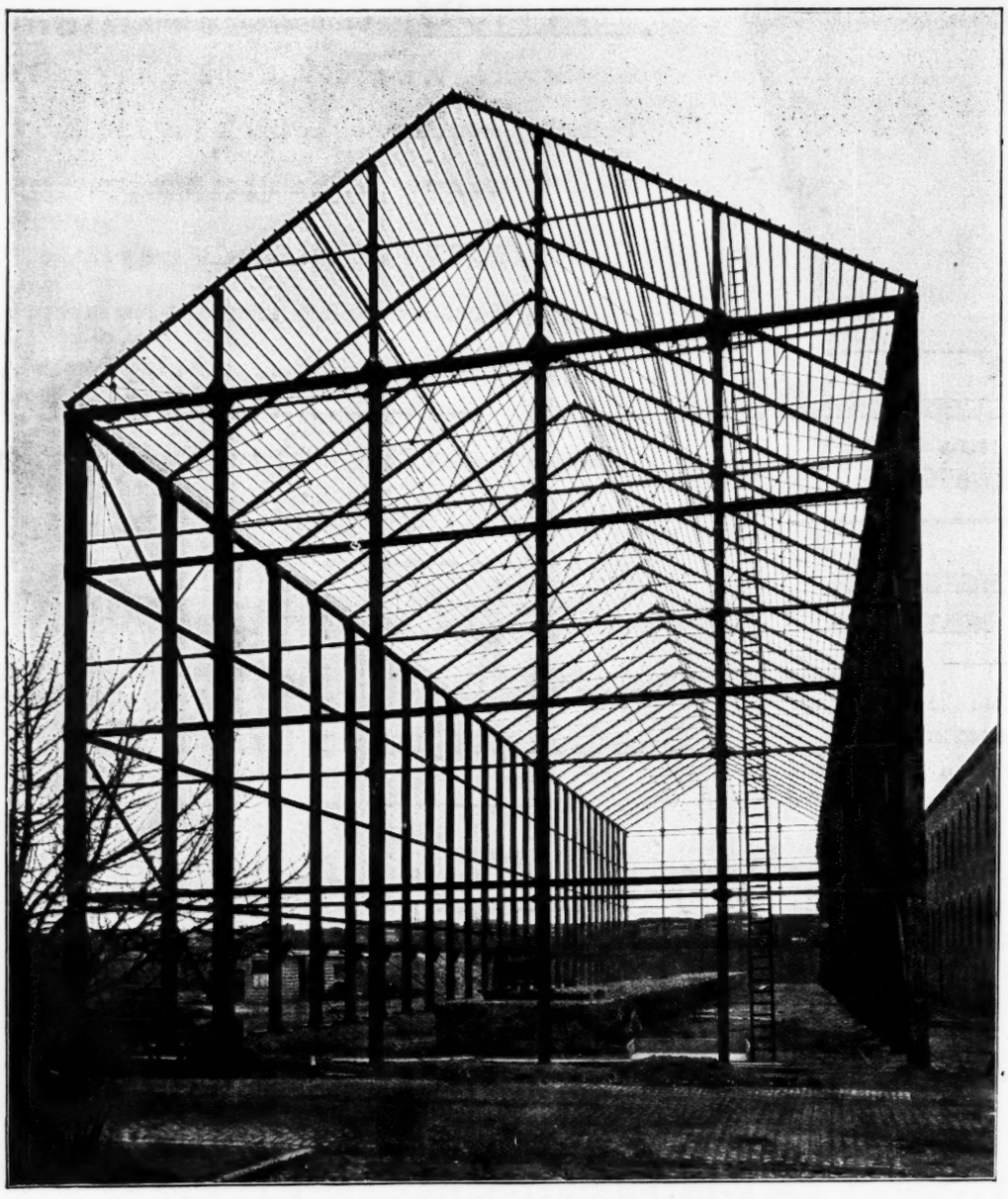

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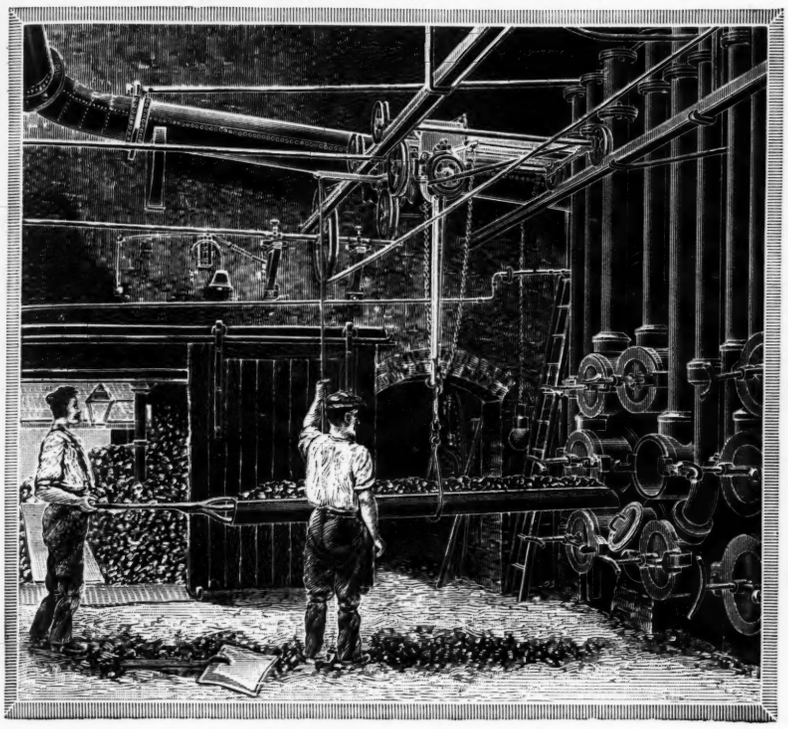

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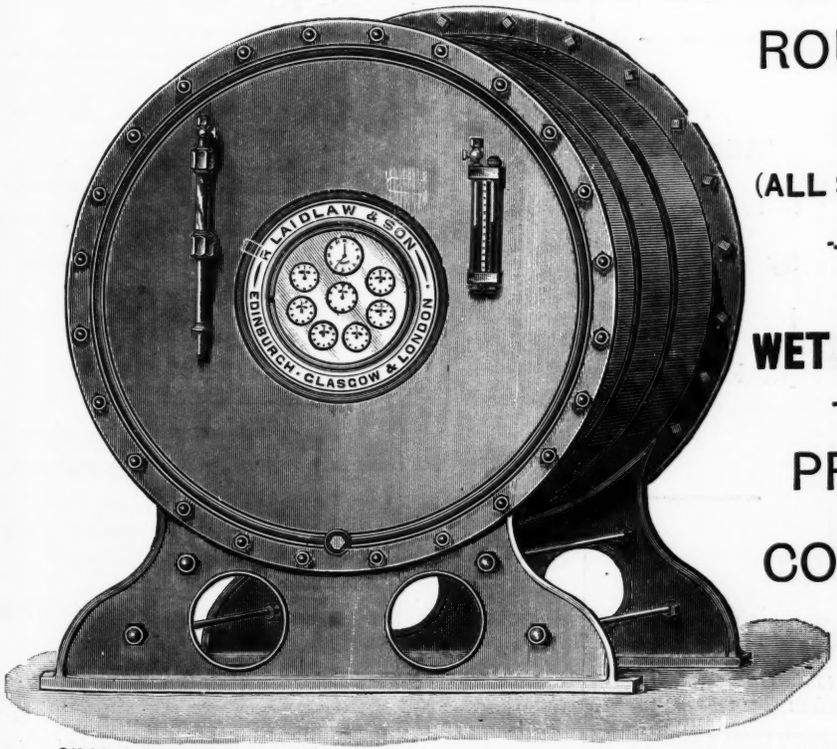

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Fire-Bricks, Fire-Clay, Lumps, and Tiles

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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, Nov. 5, p. 1204.]

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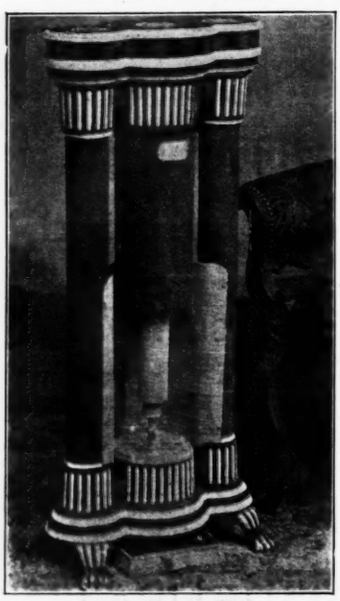
RITCHIE'S PATENT



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This Stove is let on Hire by the leading Gas Companies.

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RETORTS CAREFULLY PACKED FOR EXPORT.
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MAKERS OF THE **BIRMINGHAM.**

PATENT "SURPRISE" PENDANT,
WITH PATENT SHADE.

The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

Extract from the JOURNAL OF GAS LIGHTING, Jan. 8, 1895.

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THE INCANDESCENT GAS-LIGHT
it quite **supersedes** the familiar three-light pendant. We are able to bear witness to the **convenience** of the New Pendant."

INCANDESCENT GAS LIGHTING.

Season 1901-1902.

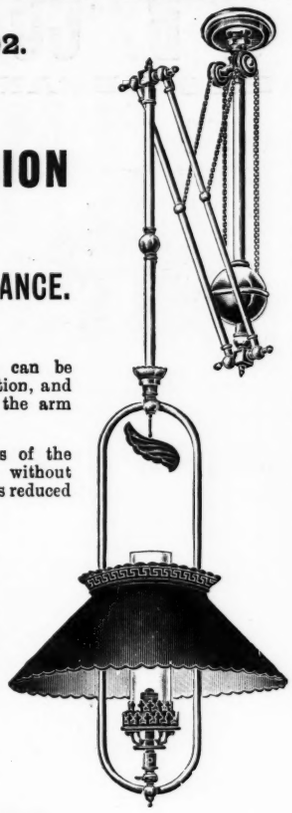
NEW PATENT

GAS SUSPENSION

WITH

PARALLEL MOTION AND BALANCE.

(COWAN'S PATENT.)



These Patent Gas Suspensions can be readily adjusted to any desired position, and can be turned to the right or left, the arm having a radius of 17 inches.

They possess all the advantages of the well-known water-slide principle, without the aid of a water-seal. Vibration is reduced to a minimum.

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ALL KINDS GAS PLANT
12,000,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
IT IS 300 FT DIAM. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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[See also Advt. p. 1220.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Olding, Ltd., 12, Gough Square), and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Nov. 12, 1901.